VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF BIO SCIENCES AND TECHNOLOGY

B.Tech Biotechnology

(B.Tech BBT)

Curriculum

(2019-2020 admitted students)

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VISION STATEMENT OF VELLORE INSTITUTE OF TECHNOLOGY

Transforming life through excellence in education and research.

MISSION STATEMENT OF VELLORE INSTITUTE OF TECHNOLOGY

World class Education: Excellence in education, grounded in ethics and critical thinking, for improvement of life.

Cutting edge Research: An innovation ecosystem to extend knowledge and solve critical problems.

Impactful People: Happy, accountable, caring and effective workforce and students.

Rewarding Co-creations: Active collaboration with national & international industries & universities for productivity and economic development.

Service to Society: Service to the region and world through knowledge and compassion.

VISION STATEMENT OF THE SCHOOL OF BIO SCIENCES AND TECHNOLOGY

To nurture high-quality bioengineers and science graduates with the potential to innovate, invent and disseminate knowledge for the benefit of society and environment.

MISSION STATEMENT OF THE SCHOOL OF BIO SCIENCES AND TECHNOLOGY

- To create opportunities for multi-disciplinary education, training and research in biotechnology and bio-sciences.
- To instill a spirit of innovation and creativity in young minds from across the globe with sound research aptitude.
- To foster ethically strong biologists who effectively contribute towards the growth of the nation.

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B.TECH BIOTECHNOLOGY

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs).

1. Graduates will be engineering practitioners and leaders, who would help solve industry's technological problems

2. Graduates will be engineering professionals, innovators or entrepreneurs engaged in technology development, technology deployment, or engineering system implementation in industry

3. Graduates will function in their profession with social awareness and responsibility

4. Graduates will interact with their peers in other disciplines in industry and society and contribute to the economic growth of the country

5. Graduates will be successful in pursuing higher studies in engineering or management

6. Graduates will pursue career paths in teaching or research

B.TECH BIOTECHNOLOGY

PROGRAMME OUTCOMES (POs).

PO_01: Having an ability to apply mathematics and science in engineering applications.

PO_02: Having a clear understanding of the subject related concepts and of contemporary issues and apply them to identify, formulate and analyse complex engineering problems.

PO_03: Having an ability to design a component or a product applying all the relevant standards and with realistic constraints, including public health, safety, culture, society and environment

PO_04: Having an ability to design and conduct experiments, as well as to analyse and interpret data, and synthesis of information

PO_05: Having an ability to use techniques, skills, resources and modern engineering and IT tools necessary for engineering practice

PO_06: Having problem solving ability- to assess social issues (societal, health, safety, legal and cultural) and engineering problems

PO_07: Having adaptive thinking and adaptability in relation to environmental context and sustainable development

PO_08: Having a clear understanding of professional and ethical responsibility

PO_09: Having cross cultural competency exhibited by working as a member or in teams

PO_10: Having a good working knowledge of communicating in English – communication with engineering community and society

PO_11: Having a good cognitive load management skills related to project management and finance

PO_12: Having interest and recognise the need for independent and lifelong learning

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ADDITIONAL PROGRAMME OUTCOMES (APOs).

APO_01: Having an ability to be socially intelligent with good SIQ (Social Intelligence Quotient) and EQ (Emotional Quotient)

APO_02: Having Sense-Making Skills of creating unique insights in what is being seen or observed (Higher level thinking skills which cannot be codified)

APO_03: Having design thinking capability

APO_04: Having computational thinking (Ability to translate vast data in to abstract concepts and to understand database reasoning

APO_05: Having Virtual Collaborating ability

APO_06: Having an ability to use the social media effectively for productive use

APO_07: Having critical thinking and innovative skills

APO_08: Having a good digital footprint

B.TECH BIOTECHNOLOGY

PROGRAMME SPECIFIC OUTCOMES (PSOs)

On completion of B. Tech. (Biotechnology) programme, graduates will be able to

- PSO1: Apply knowledge to find innovative solutions for biotechnological problems
- PSO2: Explore problems related to biotechnology and provide valid conclusions through industry-academia interface
- PSO3: Infer the potentials and impact of biotechnological innovations for finding sustainable ethical solutions to issues pertaining to health, environment and agriculture

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B.TECH BIOTECHNOLOGY

CREDIT STRUCTURE

Category-wise Credit distribution

Category	**Credits**
University core (UC)	53
Programme core (PC)	51
Programme elective (PE)	44
University elective (UE)	12
Bridge course (BC)	4 (Not counted for credits)
Total credits	**160**

B.TECH BIOTECHNOLOGY

DETAILED CURRICULUM

University Core

S. No.	Course Code	Course Title	L	T	P	J	C
1	BIT3099	Industrial Internship	0	0	0	0	2
2	BIT3999	Technical Answers for Real World Problems (TARP)	1	0	0	8	3
3	BIT4098	Comprehensive Examination	0	0	0	0	2
4	BIT4099	Capstone Project	0	0	0	0	12
5	CHY1002	Environmental Sciences	3	0	0	0	3
6	CHY1701	Engineering Chemistry	3	0	2	0	4
7	CSE1001	Problem Solving and Programming	0	0	6	0	3
8	CSE1002	Problem Solving and Object Oriented Programming	0	0	6	0	3
9	ENG1011	English for Engineers	0	0	4	0	2
10	FLC4097	Foreign Language Course Basket	0	0	0	0	2
11	HUM1021	Ethics and Values	2	0	0	0	2
12	MAT1011	Calculus for Engineers	3	0	2	0	4
13	MAT2001	Statistics for Engineers	2	1	2	0	4
14	MGT1022	Lean Start-up Management	1	0	0	4	2

15	PHY1701	Engineering Physics	3	0	2	0	4
16	PHY1999	Introduction to Innovative Projects	1	0	0	4	2
17	EXC4097	Co-Extra Curricular Basket	0	0	0	0	2
18	STS4097	Soft Skills Course Basket	0	0	0	0	6

B.TECH BIOTECHNOLOGY

Programme Core

S. No.	Course Code	Course Title	L	T	P	J	C
1	BIT1005	Biochemistry	3	0	2	0	4
2	BIT1006	Cell Biology and Genetics	3	0	2	0	4
3	BIT1007	Microbiology	2	0	2	4	4
4	BIT1008	Principles of Chemical Engineering	3	0	2	0	4
5	BIT2004	Bioinformatics	2	0	2	0	3
6	BIT2005	Analytical Techniques in Biotechnology	3	0	4	0	5
7	BIT2006	Molecular Biology	3	0	2	0	4
8	BIT2007	Down Stream Processing	2	1	2	0	4
9	BIT2008	Immunology and Immunotechnology	3	0	2	0	4
10	BIT2017	Industrial Biotechnology	3	0	0	4	4
11	BIT2020	Chemical Reaction Engineering and Unit Operations	2	1	0	0	3

12	BIT3006	Genetic Engineering	3	0	2	0	4
13	BIT3012	Bioprocess Engineering and Bioreactor Design	2	1	2	0	4

B.TECH BIOTECHNOLOGY

Programme Electives

S. No.	Course Code	Course Title	L	T	P	J	C
1	BIT1002	Biostatistics	3	0	0	0	3
2	BIT1009	Biobusiness	3	0	0	4	4
3	BIT1010	Computational Biochemistry	2	0	0	4	3
4	BIT1011	Social Entrepreneurship	2	0	0	4	3
5	BIT2009	Protein Engineering and Design	3	0	0	4	4
6	BIT2010	Pharmaceutical Biotechnology	3	0	0	4	4
7	BIT2011	Developmental Biology and Regenerative Medicine	3	0	0	0	3
8	BIT2012	Metabolic Engineering	3	0	0	0	3
9	BIT2013	Industrial Enzymology	3	0	0	0	3
10	BIT2014	Proteomics	2	0	2	0	3
11	BIT2015	Stem Cell Technology	3	0	2	0	4
12	BIT2016	Cancer Biology and Informatics	3	0	0	0	3
13	BIT2018	Food Biotechnology	3	0	0	0	3
14	BIT2019	Environmental Biotechnology	2	0	0	4	3

15	BIT2021	Mass and Heat Transfer Operations	2	1	0	0	3
16	BIT3004	Nanobiotechnology	3	0	0	4	4
17	BIT3005	Biological Spectroscopy	3	0	0	0	3
18	BIT3007	Animal Biotechnology	3	0	2	0	4
19	BIT3008	Plant Biotechnology	3	0	0	0	3
20	BIT3009	Forensic Science and Technology	3	0	0	4	4
21	BIT3010	Food Process Technology	2	0	0	4	3
22	BIT3011	Plant Cell and Tissue Culture	2	0	4	0	4
23	BIT4001	Bioprocess Plant Design, Economics and Optimization	3	0	0	0	3
24	BIT4002	Medical Diagnostics	3	0	0	4	4
25	BIT4003	Molecular Modelling and Drug Design	3	0	0	0	3
26	BIT4004	Tissue Engineering	3	0	0	4	4
27	BIT4005	Genomics	2	0	2	0	3
28	BIT4006	Neurobiology and Cognitive Science	3	0	0	4	4

University Electives (12 credits)

S. No.	Course Code	Course Title	L	T	P	J	C
1	UE	Management Course Basket/ Humanity Course Basket/ Other school Basket/ SBST school Basket					

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niversity Electives (School Basket Course for B.Tech Biotechnology Students)

S. No.	Course Code	Course Title	L	T	P	J	C
1	BIT1026	Food, Nutrition And Health	3	0	0	0	3
2	BIT1027	Introduction to Research Methods	2	0	0	4	3
3	BIT1028	Bio-inspired design	2	0	0	4	3

Bridge Courses (Not counted for Credits)

S. No.	Course Code	Course Title	L	T	P	J	C
1	BIT1001	Introduction to Life Sciences	4	0	0	0	4
2	MAT1001	Fundamentals of Mathematics	3	2	0	0	4
3	ENG1002	Effective English	0	0	4	0	2

Management courses

Sl.No	Code	Title	L	T	P	J	C
1	MGT1001	Basic Accounting	3	0	0	0	3
2	MGT1002	Principles of Management	2	0	0	4	3
3	MGT1003	Economics for Engineers	2	0	0	4	3
4	MGT1004	Resource Management	2	0	0	4	3
5	MGT1005	Design, Systems and Society	2	0	0	4	3
6	MGT1006	Environmental and Sustainability Assessment	2	0	0	4	3

7	MGT1007	Gender, Culture and Technology	2	0	0	4	3
8	MGT1008	Impact of Information Systems on Society	2	0	0	4	3
9	MGT1009	Technological Change and Entrepreneurship	2	0	0	4	3
10	MGT1010	Total Quality Management	2	2	0	0	3
11	MGT1014	Supply Chain Management	3	0	0	0	3
12	MGT1015	Business Mathematics	3	0	0	0	3
13	MGT1016	Intellectual Property Rights	3	0	0	0	3
14	MGT1017	Business Regulatory Framework For Start-ups	3	0	0	0	3
15	MGT1018	Consumer Behaviour	3	0	0	0	3
16	MGT1019	Services Marketing	3	0	0	0	3
17	MGT1020	Marketing Analytics	2	0	2	0	3
18	MGT1021	Digital and Social Media Marketing	3	0	0	0	3
19	MGT1022	Lean Start-up Management	1	0	0	4	2
20	MGT1023	Fundamentals of Human Resource Management	3	0	0	4	4
21	MGT1024	Organizational Behaviour	3	0	0	4	4
22	MGT1025	Foundations of Management And Organizational Behaviour	3	0	0	4	4
23	MGT1026	Information Assurance and Auditing	2	0	0	4	3
24	MGT1028	Accounting and Financial Management	2	2	0	4	4

25	MGT1029	Financial Management	2	1	0	4	4
26	MGT1030	Entrepreneurship Development	3	0	0	4	4
27	MGT1031	International Business	3	0	0	4	4
28	MGT1032	Managing Asian Business	3	0	0	4	4
29	MGT1033	Research Methods in Management	2	1	0	4	4
30	MGT1034	Project Management	3	0	0	4	4
31	MGT1035	Operations Management	3	0	0	0	3
32	MGT1036	Principles of Marketing	3	0	0	4	4
33	MGT1037	Financial Accounting and Analysis	2	1	0	4	4
34	MGT1038	Financial Econometrics	2	0	0	4	3
35	MGT1039	Financial Markets and Institutions	2	0	0	4	3
36	MGT1040	Personal Financial Planning	2	0	0	4	3
37	MGT1041	Financial Derivatives	2	1	0	4	4
38	MGT1042	Investment Analysis and Portfolio Management	2	0	0	4	3
39	MGT1043	Applications in Neuro Marketing	3	0	0	4	4
40	MGT1044	Global Brand Marketing Strategies	3	0	0	4	4
41	MGT1045	Industrial Marketing	3	0	0	4	4
42	MGT1046	Sales and Distribution Management	3	0	0	4	4
43	MGT1047	Social Marketing	3	0	0	4	4

44	MGT1048	Political Economy of Globalization	3	0	0	4	4
45	MGT1049	Sustainable Business Models	3	0	0	4	4
46	MGT1050	Software Engineering Management	2	0	0	4	3
47	MGT1051	Business Analytics for Engineers	2	2	0	0	3
48	MGT1052	Bottom of the Pyramid Operations	3	0	0	0	3
49	MGT1053	Entrepreneurship Development, Business Communication and IPR	1	0	2	0	2
50	MGT1054	Product Planning and Strategy	2	2	0	0	3
51	MGT1055	Design Management	2	2	0	0	3
52	MGT1056	Accounting and Financial Management	3	0	0	4	4
53	MGT6001	Organizational Behaviour	2	0	0	4	3

Humanities courses

Sl.No	**Code**	**Title**	**L**	**T**	**P**	**J**	**C**
1	HUM1001	Fundamentals of Cyber Laws	3	0	0	0	3
2	HUM1002	Business Laws	3	0	0	0	3
3	HUM1003	Basic Taxation for Engineers	3	0	0	0	3
4	HUM1004	Corporate Law for Engineers	3	0	0	0	3
5	HUM1005	Cost Accounting for Engineers	3	0	0	0	3
6	HUM1006	Business Accounting for Engineers	3	0	0	0	3

7	HUM1007	Contemporary Legal Framework for Business	3	0	0	0	3
8	HUM1009	International Business	3	0	0	0	3
9	HUM1010	Foreign Trade Environment	3	0	0	0	3
10	HUM1011	Export Business	3	0	0	0	3
11	HUM1012	Introduction to Sociology	3	0	0	0	3
12	HUM1013	Population Studies	3	0	0	0	3
13	HUM1021	Ethics and Values	2	0	0	0	2
14	HUM1022	Psychology in Everyday Life	2	0	0	4	2
15	HUM1023	Indian Heritage and Culture	2	0	0	4	2
16	HUM1024	India and Contemporary World	2	0	0	4	2
17	HUM1025	Indian Classical Music	1	0	2	4	1
18	HUM1033	Micro Economics	3	0	0	0	3
19	HUM1034	Macro Economics	3	0	0	0	3
20	HUM1035	Introductory Econometrics	2	0	2	0	2
21	HUM1036	Engineering Economics and Decision Analysis	2	0	0	4	2
22	HUM1037	Applied Game Theory	2	0	0	4	2
23	HUM1038	International Economics	3	0	0	0	3
24	HUM1039	Community Development in India	2	0	0	4	2
25	HUM1040	Indian Social Problems	3	0	0	0	3

26	HUM1041	Indian Society Structure and Change	3	0	0	0	3
27	HUM1042	Industrial Relations and Labour Welfare in India	3	0	0	0	3
28	HUM1043	Mass Media and Society	2	0	0	4	2
29	HUM1044	Network Society	3	0	0	0	3
30	HUM1045	Introduction to Psychology	2	0	2	0	2
31	HUM1706	Business Accounting for Engineers	3	0	0	0	3

UNIVERSITY CORE

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Course code	Course Title	L	T	P	J	C
BIT 3099	Industrial Internship	0	0	0	0	2
Pre-requisite	Completion of minimum of Two semesters					

Course Objectives:

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Expected Course Outcome:

At the end of this internship the student should be able to:

1. Have an exposure to industrial practices and to work in teams
2. Communicate effectively
3. Understand the impact of engineering solutions in a global, economic, environmental and societal context
4. Develop the ability to engage in research and to involve in life-long learning
5. Comprehend contemporary issues
6. Engage in establishing his/her digital footprint

Student Learning Outcomes (SLO):	2,9,11,13,16

Contents	4 Weeks

Four weeks of work at industry site.

Supervised by an expert at the industry.

Mode of Evaluation: Internship Report, Presentation and Project Review

Recommended by Board of Studies	28-02-2016		
Approved by Academic Council	No. 37	Date	16-06-2015

ourse code	Course Title	L	T	P	J	C
BIT 3999	Technical Answers for Real World Problems (TARP)	1	0	0	8	3
Pre-requisite	PHY1999 and 115 Credits Earned					Syllabus version
						1.0

Course Objectives:

1. To help students to identify the need for developing newer technologies for industrial / societal needs
2. To train students to propose and implement relevant technology for the development of the prototypes/products
3. To make the students learn to the use the methodologies available to assess the developed prototypes/products

Expected Course Outcome:

At the end of the course, the student will be able to

1. Identify real life problems related to society
2. Apply appropriate technology(ies) to address the identified problems using engineering principles and arrive at innovative solutions

Student Learning Outcomes (SLO):	9,18

Module:1		15 hours

1. Identification of real life problems
2. Field visits can be arranged by the faculty concerned
3. 6 – 10 students can form a team (within the same / different discipline)
4. Minimum of eight hours on self-managed team activity
5. Appropriate scientific methodologies to be utilized to solve the identified issue
6. Solution should be in the form of fabrication/coding/modeling/product design/process design/relevant scientific methodology(ies)

7. Consolidated report to be submitted for assessment 8. Participation, involvement and contribution in group discussions during the contact hours will be used as the modalities for the continuous assessment of the theory component 9. Project outcome to be evaluated in terms of technical, economical, social, environmental, political and demographic feasibility 10. Contribution of each group member to be assessed 11. The project component to have three reviews with the weightage of 20:30:50
Mode of Evaluation: (No FAT) Continuous Assessment for the project done – Mark weightage of 20:30:50 – project report to be submitted, presentation and project reviews

Recommended by Board of Studies	28-02-2016		
Approved by Academic Council	No. 37	Date	16-06-2015

Course code	Course Title	L	T	P	J	C
BIT 4098	COMPREHENSIVE EXAMINATION	0	0	0	0	2

Module 1:

Biochemistry: Foundation of biochemistry, Carbohydrates, Amino acids and Proteins, Lipids and Nucleic acids. Analytical Techniques in Biotechnology: Lab Practices and Sampling, Analytical Lab, Standard Operating Procedures, Physico-chemical analyses, Spectrometry, Electrophoresis and chromatography, Mass Spectrometry and NMR. Pharmaceutical Biotechnology: General pharmacology, Pharmacology, Formulating Biotech drugs, Biotech drugs, Clinical Trials & Regulations. Metabolic Engineering: Introduction to Metabolic engineering, Regulation of metabolic pathways and manipulations, Metabolic flux analysis, Metabolic control analysis, Applications of Metabolic Engineering.

Module 2:

Cell Biology and Genetics: Cell structure and function, Transport across cell membranes, Cell signalling, motility and integration, Mechanisms of inheritance, Evolution and genetic applications. Molecular Biology: Chromosomes, DNA, Transcription, translation, Retroviruses and recombination - transformation, conjugation, transduction. Immunology: The Immune System, Humoral Immune responses, Cellular Immune responses, Immunity to infection, Immunology of transplantation. Genetic Engineering: Concepts of Recombinant DNA technology, Tool enzymes, Vectors, Gene cloning strategies, Polymerase chain reaction.

Module 3:

Chemical Reaction Engineering: Basic of Kinetics, Introduction to reactor design, Flow behaviour of Reactors, Heat Exchanger, Drying. Downstream Processing: Role of Downstream Processing in Biotechnology, Primary Separation and Recovery Processes, Enrichment Operations, Product resolution, Product Polishing. Bioprocess Economics and Plant Design: Process Design Development, General design Consideration, Co, st Estimation, Plant overheads and depreciation, Profitability Analysis.

Module 4:

Animal Biotechnology: Introduction to Physiology, Neurotransmitters and Nervous system, Animal Cell Technology and its applications, Animal Reproductive Biotechnology, Transgenic animals & Transgenic engineering. Plant Biotechnology: Plant growth and development, Plant genome Organization and Tissue culture, Plant transformation, transgenic plants, Marker technology. Bioinformatics: Introduction to Bioinformatics Databases, Sequence Alignment and Database searches, Phylogeny Analysis, Structural bioinformatics, Applications of Bioinformatics.

Module 5:

Microbiology: Tools in Microbiology, Morphology and Taxonomy, metabolisms of microorganism, Microbial growth, Applied Microbiology. Food Biotechnology: Introduction to Food Biotechnology, Biotechnological principles in food produce, Microbial Biotechnology in Food, Biotechnology in food quality assurance, Food biotechnology and consumerism. Industrial Biotechnology: Introduction to Industrial Bioprocess, Metabolic Stoichiometry, Raw Material for Fermentation Process, Production of Primary and Secondary Metabolites, Strain Development.

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Course Code	Course Title	L	T	P	J	C
BIT 4099	Capstone Project	0	0	0	0	12
Pre-requisite	As per the academic regulations	Syllabus version				
		1.0				

Course Objectives:

To provide sufficient hands-on learning experience related to the design, development and analysis of suitable product / process so as to enhance the technical skill sets in the chosen field.

Expected Course Outcome:

At the end of the course the student will be able to

1. Formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints.
2. Perform literature search and / or patent search in the area of interest.
3. Conduct experiments / design and analysis / solution iterations and document the results.
4. Perform error analysis / benchmarking / costing
5. Synthesise the results and arrive at scientific conclusions / products / solution
6. Document the results in the form of technical report / presentation

Student Learning Outcomes (SLO):	5, 6, 20

Contents

1. Capstone Project may be a theoretical analysis, modeling & simulation, experimentation & analysis, prototype design, fabrication of new equipment, correlation and analysis of data, software development, applied research and any other related activities.
2. Project can be for one or two semesters based on the completion of required number of credits as per the academic regulations.
3. Can be individual work or a group project, with a maximum of 3 students.
4. In case of group projects, the individual project report of each student should specify the individual's contribution to the group project.
5. Carried out inside or outside the university, in any relevant industry or research institution.

6. Publications in the peer reviewed journals / International Conferences will be an added advantage			
Mode of Evaluation: Periodic reviews, Presentation, Final oral viva, Poster submission			
Recommended by Board of Studies	10-06-2015		
Approved by Academic Council	No. 37	Date	16-06-2015

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Course code	Course Title	L	T	P	J	C
CHY1002	Environmental Sciences	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		V:1.1				

Course Objectives:

1. To make students understand and appreciate the unity of life in all its forms, the implications of life style on the environment.
2. To understand the various causes for environmental degradation.
3. To understand individuals contribution in the environmental pollution.
4. To understand the impact of pollution at the global level and also in the local environment.

Expected Course Outcome: Students will be able to

1. Students will **recognize** the environmental issues in a problem oriented interdisciplinary perspectives
2. Students will **understand** the key environmental issues, the science behind those problems and potential solutions.
3. Students will **demonstrate** the significance of biodiversity and its preservation
4. Students will **identify** various environmental hazards
5. Students will **design** various methods for the conservation of resources
6. Students will **formulate** action plans for sustainable alternatives that incorporate science, humanity, and social aspects
7. Students will have foundational **knowledge** enabling them to make sound life decisions as well as enter a career in an environmental profession or higher education.

Student Learning Outcomes (SLO):	1,2,3,4,5,9,11,12	
Module:1	**Environment and Ecosystem**	**7 hours**
Key environmental problems, their basic causes and sustainable solutions. IPAT equation. Ecosystem, earth – life support system and ecosystem components; Food chain, food web, Energy flow in ecosystem; Ecological succession- stages involved, Primary and secondary succession, Hydrarch, mesarch, xerarch; Nutrient, water, carbon, nitrogen, cycles; Effect of human activities on these cycles.		
Module:2	**Biodiversity**	**6 hours**
Importance, types, mega-biodiversity; Species interaction - Extinct, endemic, endangered and rare species; Hot-spots; GM crops- Advantages and disadvantages; Terrestrial biodiversity and Aquatic biodiversity – Significance, Threats due to natural and anthropogenic activities and Conservation methods.		
Module:3	**Sustaining Natural Resources and Environmental Quality**	**7 hours**
Environmental hazards – causes and solutions. Biological hazards – AIDS, Malaria, Chemical hazards- BPA, PCB, Phthalates, Mercury, Nuclear hazards- Risk and evaluation of hazards. Water footprint; virtual water, blue revolution. Water quality management and its conservation. Solid and hazardous waste – types and waste management methods.		
Module:4	**Energy Resources**	**6 hours**

Renewable - Non renewable energy resources- Advantages and disadvantages - oil, Natural gas, Coal, Nuclear energy. Energy efficiency and renewable energy. Solar energy, Hydroelectric power, Ocean thermal energy, Wind and geothermal energy. Energy from biomass, solar-Hydrogen revolution.		
Module:5	**Environmental Impact Assessment**	**6 hours**
Introduction to environmental impact analysis. EIA guidelines, Notification of Government of India (Environmental Protection Act – Air, water, forest and wild life). Impact assessment methodologies. Public awareness. Environmental priorities in India.		
Module:6	**Human Population Change and Environment**	**6 hours**
Urban environmental problems; Consumerism and waste products; Promotion of economic development – Impact of population age structure – Women and child welfare, Women empowerment. Sustaining human societies: Economics, environment, policies and education.		
Module:7	**Global Climatic Change and Mitigation**	**5 hours**
Climate disruption, Green house effect, Ozone layer depletion and Acid rain. Kyoto protocol, Carbon credits, Carbon sequestration methods and Montreal Protocol. Role of Information technology in environment-Case Studies.		
Module:8	**Contemporary issues**	**2 hours**
Lecture by Industry Experts		
	Total Lecture hours:	**45 hours**
Text Books		

1.	G. Tyler Miller and Scott E. Spoolman (2016), Environmental Science, 15th Edition, Cengage learning.
2.	George Tyler Miller, Jr. and Scott Spoolman (2012), Living in the Environment – Principles, Connections and Solutions, 17th Edition, Brooks/Cole, USA.

Reference Books

1.	David M.Hassenzahl, Mary Catherine Hager, Linda R.Berg (2011), Visualizing Environmental Science, 4thEdition, John Wiley & Sons, USA.

Mode of evaluation: Internal Assessment (CAT, Quizzes, Digital Assignments) & FAT

Recommended by Board of Studies	12.08.2017		
Approved by Academic Council	No. 46	Date	24.08.2017

Course code	Course Title	L	T	P	J	C
CHY1701	Engineering Chemistry	3	0	2	0	4
Pre-requisite	Nil	Syllabus version				
		1.1				

Course Objectives:

1. To impart technological aspects of applied chemistry
2. To lay foundation for practical application of chemistry in engineering aspects

Expected Course Outcomes (CO): Students will be able to

1. **Recall** and **analyze** the issues related to impurities in water and their removal methods and **apply** recent methodologies in water treatment for domestic and industrial usage
2. **Evaluate** the causes of metallic corrosion and **apply** the methods for corrosion protection of metals
3. **Evaluate** the electrochemical energy storage systems such as lithium batteries, fuel cells and solar cells, and **design** for usage in electrical and electronic applications
4. **Assess** the quality of different fossil fuels and create an awareness to **develop** the alternative fuels
5. **Analyze** the properties of different polymers and distinguish the polymers which can be degraded and **demonstrate** their usefulness
6. **Apply** the theoretical aspects: (a) in **assessing** the water quality; (b) **understanding** the construction and working of electrochemical cells; (c) **analyzing** metals, alloys and soil using instrumental methods; (d) **evaluating** the viscosity and water absorbing properties of polymeric materials

Student Learning Outcomes involved: 1,2,14

Module:1	Water Technology	5 hours

Characteristics of hard water - hardness, DO, TDS in water and their determination – numerical problems in hardness determination by EDTA; Modern techniques of water analysis for industrial use - Disadvantages of hard water in industries.

Module:2	**Water Treatment**	**8 hours**
Water softening methods: - Lime-soda, Zeolite and ion exchange processes and their applications. Specifications of water for domestic use (ICMR and WHO); Unit processes involved in water treatment for municipal supply - Sedimentation with coagulant- Sand Filtration - chlorination; Domestic water purification – Candle filtration- activated carbon filtration; Disinfection methods- Ultrafiltration, UV treatment, Ozonolysis, Reverse Osmosis; Electro dialysis.		
Module:3	**Corrosion**	**6 hours**
Dry and wet corrosion - detrimental effects to buildings, machines, devices & decorative art forms, emphasizing Differential aeration, Pitting, Galvanic and Stress corrosion cracking; Factors that enhance corrosion and choice of parameters to mitigate corrosion.		
Module:4	**Corrosion Control**	**4 hours**
Corrosion protection - cathodic protection – sacrificial anodic and impressed current protection methods; Advanced protective coatings: electroplating and electroless plating, PVD and CVD. Alloying for corrosion protection – Basic concepts of Eutectic composition and Eutectic mixtures - Selected examples – Ferrous and non-ferrous alloys.		
Module:5	**Electrochemical Energy Systems**	**6 hours**
Brief introduction to conventional primary and secondary batteries; High energy electrochemical energy systems: Lithium batteries – Primary and secondary, its Chemistry, advantages and applications. Fuel cells – Polymer membrane fuel cells, Solid-oxide fuel cells- working principles, advantages, applications. Solar cells – Types – Importance of silicon single crystal, polycrystalline and amorphous silicon solar cells, dye sensitized solar cells - working principles, characteristics and applications.		
Module:6	**Fuels and Combustion**	**8 hours**
Calorific value - Definition of LCV, HCV. Measurement of calorific value using bomb calorimeter and Boy's calorimeter including numerical problems.		

Controlled combustion of fuels - Air fuel ratio – minimum quantity of air by volume and by weight-Numerical problems-three way catalytic converter- selective catalytic reduction of NO_X; Knocking in IC engines-Octane and Cetane number - Antiknocking agents.		
Module:7	**Polymers**	**6 hours**
Difference between thermoplastics and thermosetting plastics; Engineering application of plastics - ABS, PVC, PTFE and Bakelite; Compounding of plastics: moulding of plastics for Car parts, bottle caps (Injection moulding), Pipes, Hoses (Extrusion moulding), Mobile Phone Cases, Battery Trays, (Compression moulding), Fibre reinforced polymers, Composites (Transfer moulding), PET bottles (blow moulding); Conducting polymers- Polyacetylene- Mechanism of conduction – applications (polymers in sensors, self-cleaning windows)		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industry Experts		
	Total Lecture hours:	**45 hours**
Text Book(s)		
1.	1. Sashi Chawla, A Text book of Engineering Chemistry, Dhanpat Rai Publishing Co., Pvt. Ltd., Educational and Technical Publishers, New Delhi, 3rd Edition, 2015. 2. O.G. Palanna, McGraw Hill Education (India) Private Limited, 9th Reprint, 2015. 3. B. Sivasankar, Engineering Chemistry 1st Edition, Mc Graw Hill Education (India), 2008 4. "Photovoltaic solar energy : From fundamentals to Applications", AngÃ¨le Reinders, Pierre Verlinden, Wilfried van Sark, Alexandre Freundlich, Wiley publishers, 2017.	
Reference Books		
2	1. O.V. Roussak and H.D. Gesser, ***Applied Chemistry-A Text Book for Engineers and Technologists***, Springer Science Business Media, New York, 2nd Edition, 2013. 2. S. S. Dara, ***A Text book of Engineering Chemistry,*** S. Chand & Co Ltd., New Delhi, 20th Edition, 2013.	
Mode of Evaluation: Internal Assessment (CAT, Quizzes, Digital Assignments) & FAT		
List of Experiments		

	Experiment title	Hours
1.	Water Purification: Estimation of water hardness by EDTA method and its removal by ion-exchange resin	1 h 30 min
2. 3.	Water Quality Monitoring: Assessment of total dissolved oxygen in different water samples by Winkler's method Estimation of sulphate/chloride in drinking water by conductivity method	3 h
4/5.	Material Analysis: Quantitative colorimetric determination of divalent metal ions of Ni/Fe/Cu using conventional and smart phone digital-imaging methods	3h
6.	Analysis of Iron in carbon steel by potentiometry	1 h 30 min
7.	Construction and working of an Zn-Cu electrochemical cell	1 h 30 min
8.	Determination of viscosity-average molecular weight of different natural/synthetic polymers	1 h 30 min
9.	Arduino microcontroller based sensor for monitoring pH/temperature/conductivity in samples.	1 h 30 min
	Total Laboratory Hours	17 hours

Mode of Evaluation: Viva-voce and Lab performance & FAT			
Recommended by Board of Studies	**31-05-2019**		
Approved by Academic Council	**54th ACM**	**Date**	**13-06-2019**

Course code	Course Title	L	T	P	J	C
CSE1001	PROBLEM SOLVING AND PROGRAMMING	0	0	6	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives:

1. To develop broad understanding of computers, programming languages and their generations
2.Introduce the essential skills for a logical thinking for problem solving
3.To gain expertise in essential skills in programming for problem solving using computer

Expected Course Outcome:

1.Understand the working principle of a computer and identify the purpose of a computer programming language
2.Learn various problem solving approaches and ability to identify an appropriate approach to solve the problem
3.Differentiate the programming Language constructs appropriately to solve any problem
4.Solve various engineering problems using different data structures
5.Able to modulate the given problem using structural approach of programming
6.Efficiently handle data using flat files to process and store data for the given problem

Student Learning Outcomes (SLO): 1,12,14

Text Book(s)

1. John V. Guttag., 2016. Introduction to computation and programming using python: with applications to understanding data. PHI Publisher.

Reference Books

1. Charles Severance.2016.Python for everybody: exploring data in Python 3, Charles Severance.
2. Charles Dierbach.2013.Introduction to computer science using python: a computational problem-solving focus. Wiley Publishers.

Mode of Evaluation: PAT / CAT/ FAT

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Challenging Experiments (Indicative)		
1.	Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool	3 Hours
2.	Introduction to Python, Demo on IDE, Keywords, Identifiers, I/O Statements,Simple Program to display Hello world in Python.	4 Hours
3.	Operators and Expressions in Python	4 Hours
4.	Algorithmic Approach 1: Sequential	2 Hours
5.	Algorithmic Approach 2: Selection (if, elif, if.. else, nested if else	5 Hours
6.	Algorithmic Approach 3: Iteration (while and for)	4 Hours
7	Strings and its Operations	2 Hours
8	Regular Expressions	2 Hours
9	List and its operations.	2 Hours
10	Dictionaries: operations	2 Hours
11	Tuples and its operations	2 Hours
12	Set and its operations	2 Hours
13	Functions, Recursions	2 Hours
14	Sorting Techniques (Bubble/Selection/Insertion)	4 Hours
15	Searching Techniques : Sequential Search and Binary Search	3 Hours
16	Files and its Operations	4 Hours
	Total Laboratory Hours	**45 hours**

Recommended by Board of Studies	04-04-2014		
Approved by Academic Council	No. 36	Date	23-10-2015

Course code	Course Title	L	T	P	J	C
CSE 1002	PROBLEM SOLVING AND OBJECT ORIENTED PROGRAMMING	0	0	6	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives:

1. The biological knowledge is growing very rapidly, and data analysis can hardly keep pace.
2. In the bioinformatics area, tools have been developed and will be advanced to handle the huge and rapidly growing amount of data stored in databases.
3. One main effort is to group and compare data, to gain information about single molecules compared to similar molecules

Expected Course Outcome:

1. Demonstrate the basics of procedural programming and to represent the real world entities as programming constructs.
2. Enumerate object oriented concepts and translate real-world applications into graphical representations.
3. Demonstrate the usage of classes and objects of the real world entities in applications.
4. Discriminate the reusability and multiple interfaces with same functionality based features to solve complex computing problems.
5. Illustrate possible error-handling constructs for unanticipated states/inputs and to use generic programming constructs to accommodate different datatypes.
6. Validate the program against file inputs towards solving the problem.

Student Learning Outcomes (SLO): 1,9,17

Module:1	Structured Programming	12 hours

Structured Programming conditional and looping statements - arrays - functions - pointers - dynamic memory allocation – structure

Module:2	Introduction to object oriented approach	10 hours

Introduction to object oriented approach: Why object oriented programming? - Characteristics of object oriented language: classes and objects - encapsulation - data abstraction - inheritance -polymorphism - Merits and Demerits of object oriented programming. UML - class diagram of OOP - Inline function default argument function - Exception handling (Standard) - reference: independent reference function returning reference pass by reference.

Module:3	Classes and objects	14 hours

Classes and objects: Definition of classes access specifier class versus structure constructor destructor copy constructor and its importance array of objects dynamic objects - friend function-friend class

Module:4	Polymorphism and Inheritance	26 hours

Polymorphism and Inheritance: Polymorphism - compile time polymorphism function over-loading operator overloading. Inheritance - types of inheritance - constructors and destructors in

inheritance constraints of multiple inheritance - virtual base class - run time polymorphism -function overriding.		
Module:5	**Exception handling and Templates**	**18 hours**
Exception handling and Templates Exception handling(user-defined exception) - Function template , Class template Template with inheritance , STL Container, Algorithm, Iterator - vector, list, stack, map.		
Module:6	**IO Streams and Files**	**10 hours**
IOstreams and Files IOstreams, Manipulators - overloading Inserters( ) and Extractors( ), Sequential and Random files writing and reading objects into/from files		
	Total Lecture hours:	**90 hours**

Text Book(s)

1.	Stanley B Lippman, Josee Lajoie, Barbara E, Moo, C++ primer, Fifth edition, Addison-Wesley, 2012.
2.	Ali Bahrami, Object oriented Systems development, Tata McGraw - Hill Education, 1999.
3.	Brian W. Kernighan, Dennis M. Ritchie , The C programming Language, 2nd edition,Prentice Hall Inc., 1988.

Reference Books

1.	Bjarne stroustrup, The C++ programming Language, Addison Wesley, 4th edition, 2013.
2.	Harvey M. Deitel and Paul J. Deitel, C++ How to Program, 7th edition, Prentice Hall, 2010.
3.	Maureen Sprankle and Jim Hubbard, Problem solving and Programming concepts, 9th edition, Pearson Eduction, 2014.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Challenging Experiments (Indicative)		
1.	**Postman Problem:** A postman needs to walk down every street in his area in order to deliver the mail. Assume that the distances between the streets along the roads are given. The postman starts at the post office and returns back to the post office after delivering all the mails. Implement an algorithm to help the post man to walk minimum distance for the purpose.	3 Hours
2.	Budget Allocation for Marketing Campaign: A mobile manufacturing company has got several marketing options such as Radio advertisement campaign, TV non peak hour's campaign, City top paper network, Viral marketing campaign, Web advertising. From their previous experience, they have got a statistics about paybacks for each marketing option. Given the marketing budget (rupees in crores) for the current year and details of	4 Hours

	paybacks for each option, implement an algorithm to determine the amount that shall spent on each marketing option so that the company attains the maximum profit.	
3.	**Missionaries and Cannibals:** Three missionaries and three cannibals are on one side of a river, along with a boat that can hold one or two people. Implement an algorithm to find a way to get everyone to the other side of the river, without ever leaving a group of missionaries in one place outnumbered by the cannibals in that place.	4 Hours
4.	**Register Allocation Problem:** A register is a component of a computer processor that can hold any type of data and can be accessed faster. As registers are faster to access, it is desirable to use them to the maximum so that the code execution is faster. For each code submitted to the processor, a register interference graph (RIG) is constructed. In a RIG, a node represents a temporary variable and an edge is added between two nodes (variables) t1 and t2 if they are live simultaneously at some point in the program. During register allocation, two temporaries can be allocated to the same register if there is no edge connecting them. Given a RIG representing the dependencies between variables in a code, implement an algorithm to determine the number of registers required to store the variables and speed up the code execution.	2 Hours
5.	**Selective Job Scheduling Problem:** A server is a machine that waits for requests from other machines and responds to them. The purpose of a server is to share hardware and software resources among clients. All the clients submit the jobs to the server for execution and the server may get multiple requests at a time. In such a situation, the server schedule the jobs submitted to it based on some criteria and logic. Each job contains two values namely time and memory required for execution. Assume that there are two servers that schedules jobs based on time and memory. The servers are named as Time Schedule Server and memory Schedule Server respectively. Design a OOP model and implement the time Schedule Server and memory Schedule Server. The Time Schedule Server arranges jobs based on time required for execution in ascending order whereas memory Schedule Server arranges jobs based on memory required for execution in ascending order.	5 Hours
6.	**Fragment Assembly in DNA Sequencing:** DNA, or deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms. The information in DNA is stored as a code made up of four chemical bases: adenine (A), guanine (G), cytosine (C), and thymine (T). In DNA sequencing, each DNA is sheared into millions of small fragments (reads) which assemble to form a single genomic sequence (superstring). Each read is a small string. In such a fragment assembly, given a set of reads, the objective is to determine the shortest superstring that contains all the reads. For example, given a set of strings, 000, 001, 010, 011, 100, 101, 110, 111 the shortest superstring is 0001110100. Given a set of reads,	4 Hours

	implement an algorithm to find the shortest superstring that contains all the given reads.	
7	**House Wiring:** An electrician is wiring a house which has many rooms. Each room has many power points in different locations. Given a set of power points and the distances between them, implement an algorithm to find the minimum cable required.	2 Hours
	Total Laboratory Hours	**90 hours**

Recommended by Board of Studies	29-10-2015		
Approved by Academic Council	No. 39	Date	17-12-2015

Course code	Course title	L	T	P	J	C
ENG1011	English for Engineers	0	0	4	0	2
Pre-requisite	Cleared EPT / Effective English			Syllabus version		
				2.2		

Course Objectives:

1. To facilitate effective language skills for academic purposes and real-life situations.
2. To enhance students' language and communication with focus on placement skills development.
3. To aid students apply language and communication skills in professional reading and reporting.

Expected Course Outcome:

1. Apply language skills with ease in academic and real-life situations.
2. Build up a job winning digital foot print and learn to face interviews confidently.
3. Develop good interpreting and reporting skills to aid them in research.
4. Comprehend language and communication skills in academic and social contexts.
5. Acquire vocabulary and learn strategies for error-free communication.

Student Learning Outcomes (SLO):	3,6,18

Module:1	**Listening**	**4 hours**
	Casual and Academic	
Module:2	**Speaking**	**4 hours**
	Socializing Skills - Introducing Oneself- His / Her Goals & SWOT	
Module:3	**Reading**	**2 hours**
	Skimming and Scanning	
Module:4	**Writing**	**2 hours**
	Error-free sentences, Paragraphs	
Module:5	**Listening**	**4 hours**

News (Authentic Material): Analyzing General and Domain Specific Information		
Module:6	**Speaking**	**4 hours**
Group Discussion on factual, controversial and abstract issues		
Module:7	**Reading:**	**2 hours**
Extensive Reading		
Module:8	**Writing**	**2 hours**
Email Etiquette with focus on Content and Audience		
Module:9	**Listening**	**4 hours**
Speeches : General and Domain Specific Information		
Module:10	**Speaking**	**4 hours**
Developing Persuasive Skills - Turncoat and Debate		
Module:11	**Reading**	**2 hours**
Intensive Reading		
Module:12	**Writing**	**2 hours**
Data Transcoding		
Module:13	**Cross Cultural Communication**	**4 hours**
Understanding Inter and Cross-Cultural Communication Nuances		
Module:14	**Speaking**	**4 hours**
Public Speaking/Extempore /Monologues		
Module:15	**Reading for research**	**2 hours**
Reading Scientific/Technical Articles		
Module:16	**Writing**	**2 hours**
Creating a Digital/Online Profile – LinkedIn (Résumé/Video Profile)		
Module:17	**Speaking:**	**4 hours**
Mock Job/Placement Interviews		
Module:18	**Writing**	**2 hours**
Report Writing		
Module:19	**Speaking**	**4 hours**
Presentation using Digital Tools		

Module:20	**Vocabulary**	**2 hours**
Crossword Puzzles/Word games		
	Total Lecture hours: 60 hours	
Text Book (s)		
1.	Clive Oxenden and Christina Latham-Koenig, New English File: Advanced: Teacher's Book with Test and Assessment CD-ROM: Six-level general English course for adults Paperback – Feb 2013, Oxford University Press, UK	
2	Clive Oxenden and Christina Latham-Koenig,New English File: Advanced Students Book Paperback – Feb 2012, Oxford University Press, UK	
3	Michael Vince,Language Practice for Advanced - Students Book, Feb. 2014, 4th Edition, Macmillan Education, Oxford, UnitedKingdom	
Reference Books		
1.	Steven Brown, Dorolyn Smith, Active Listening 3, 2011, 3rd Edition, Cambridge University Press,	

VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Foreign Language Course Basket

Course code	Course title	L	T	P	J	C
ESP1001	ESPAÑOL FUNDAMENTAL	2	0	0	0	2
Pre-requisite	Nil	Syllabus version				

Course Objectives:

The course gives students the necessary background to:

1. Demonstrate Proficiency in reading, writing, and speaking in basic Spanish. Learning vocabulary related to profession, education centres, day today activities, food, culture, sports and hobby, family set up, workplace, market and classroom activities is essential.
2. Demonstrate the ability to describe things and will be able to translate into English and vice versa.
3. Describe in simple terms (both in written and oral form) aspects of their background, immediate environment and matters in areas of immediate need.

Expected Course Outcome:

The students will be able to

1. remember greetings, giving personal details and Identify genders by using correct articles
2. apply the correct use of SER, ESTAR and TENER verb for describing people, place and things
3. create opinion about time and weather conditions by knowing months, days and seasons in Spanish
4. create opinion about people and places by using regular verbs
5. apply reflexive verbs for writing about daily routine and create small paragraphs about hometown, best friend and family

Student Learning Outcomes (SLO):	2, 11

Module:1	Abecedario, Saludos y Datos personales: Origen, Nacionalidad, Profesión	3 hours

Competencia Gramática: Vocales y Consonantes. Artículos definidos e indefinidos (Numero y Genero).
Competencia Escrita: Saludos y Datos personales

Module:2	Edad y posesión. Números (1-20)	3 hours

Competencia Gramática: Pronombres personales. Adjetivos. Los verbos SER y TENER.
Competencia Escrita: Escribe sobre mismo/a y los compañeros de la clase

Module:3	Vocabulario de Mi habitación. Colores. Descripción de lugares y cosas.	5 hours

Competencia Gramática: Adjetivos posesivos. El uso del verbo ESTAR. Diferencia entre SER y ESTAR.
Competencia Escrita: Mi habitación

Module:4	Mi familia. Números (21-100). Direcciones.Expresar la hora. Los meses del año.	**5hours**
Competencia Gramática: Frases preposicionales. Uso del HAY. La diferencia entre MUY y MUCHO. Uso del verbo GUSTAR Competencia Escrita: Mi familia. Dar opiniones sobre tiempo		
Module:5	Expresar fechas y el tiempo. Dar opiniones sobre personas y lugares.	**5 hours**
Competencia Gramática: Los verbos regulares (-AR, -ER, -IR) en el presente. Adjetivos demostrativos. Competencia Escrita: Mi mejor amigo/a. Expresar fechas. Traducción ingles a español y Español a Ingles.		
Module:6	Describir el diario. Las actividades cotidianas.	**3 hours**
Competencia Gramática: Los Verbos y pronombres reflexivos. Los verbos pronominales con e/ie, o/ue, e/i, u/ue. Competencia Escrita:El horario. Traducción ingles a español y Español a Ingles.		
Module:7	Dar opiniones sobre comidas y bebidas. Decir lo que está haciendo.Describir mi ciudad y Ubicar los sitios en la ciudad.	**4hours**
Competencia Gramática: Los verbos irregulares. Estar + gerundio. Poder + Infinitivo. Competencia Escrita: Conversación en un restaurante. Traducción ingles a español y Español a Ingles.Mi ciudad natal. Mi Universidad. La clase.Mi fiesta favorita.		
Module:8	**Guest Lectures/ Native Speakers**	**2 hours**
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	**Text Book**:**"Aula Internacional 1", Jaime Corpas, Eva Garcia, Agustin Garmendia, Carmen Soriano GoyalPublication ; reprintedEdition, (2010)**
Reference Books	
1	"¡AcciónGramática!" Phil Turk and Mike Zollo, Hodder Murray, London 2006. "Practice makes perfect: Spanish Vocabulary", Dorothy Richmond, McGraw Hill Contemporary, USA, 2012.
2	"Practice makes perfect: Basic Spanish", Dorothy Richmond, McGraw Hill Contemporary, and USA 2009.
3	"Pasaporte A1 Foundation", Matilde Cerrolaza Aragón, Óscar Cerrolaza Gili, Begoña Llovet Barquero, Edelsa Grupo, España, 2010.

Recommended by Board of Studies	22-02-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

Course code	Course Title	L	T	P	J	C
FRE1001	Français Quotidien	2	0	0	0	2
Pre-requisite	NIL	Syllabus version				
		1.0				

Course Objectives:

The course gives students the necessary background to:

1. learn the basics of French language and to communicate effectively in French in their day to day life.
2. Achieve functional proficiency in listening, speaking, reading and writing
3. Recognize culture-specific perspectives and values embedded in French language.

Expected Course Outcome:

The students will be able to :

1. identify in French language the daily life communicative situations via personal pronouns, emphatic pronouns, salutations, negations and interrogations**.**
2. communicate effectively in French language via regular / irregular verbs.
3. demonstrate comprehension of the spoken / written language in translating simple sentences.
4. understand and demonstrate the comprehension of some particular new range of unseen written materials
5. demonstrate a clear understanding of the French culture through the language studied

Student Learning Outcomes (SLO):	2,11

Module:1	Expressions simples	3 hours

Les Salutations, Les nombres (1-100), Les jours de la semaine, Les mois de l'année, Les Pronoms Sujets, Les Pronoms Toniques, La conjugaison des verbes irréguliers- avoir / être / aller / venir / faire etc.
Savoir-faire pour:
Saluer, Se présenter, Présenter quelqu'un, Etablir des contacts

Module:2	La conjugaison des verbes réguliers	3 hours

La conjugaison des verbes réguliers, La conjugaison des verbes pronominaux, La Négation, L'interrogation avec 'Est-ce que ou sans Est-ce que'.
Savoir-faire pour:
Chercher un(e) correspondant(e), Demander des nouvelles d'une personne.

Module:3	La Nationalité du Pays, L'article (défini/ indéfini), Les prépositions	6 hours

La Nationalité du Pays, L'article (défini/ indéfini), Les prépositions (à/en/au/aux/sur/dans/avec etc.), L'article contracté, Les heures en français, L'adjectif (La Couleur, L'adjectif possessif, L'adjectif démonstratif/ L'adjectif interrogatif (quel/quelles/quelle/quelles), L'accord des adjectifs avec le nom, L'interrogation avec Comment/ Combien / Où etc. Savoir-faire pour: Poser des questions, Dire la date et les heures en français,		
Module:4	**La traduction simple**	**4 hours**
La traduction simple :(français-anglais / anglais –français), Savoir-faire pour : Faire des achats, Comprendre un texte court, Demander et indiquer le chemin.		
Module:5	**L'article Partitif, Mettez les phrases aux pluriels**	**5 hours**
L'article Partitif, Mettez les phrases aux pluriels, Faites une phrase avec les mots donnés, Trouvez les questions. Savoir-faire pour : Répondez aux questions générales en français, Exprimez les phrases données au Masculin ou au Féminin, Associez les phrases.		
Module:6	**Décrivez :**	**3 hours**
Décrivez : La Famille / La Maison / L'université /Les Loisirs/ La Vie quotidienne etc.		
Module:7	Dialogue	**4 hours**
Dialogue : 1. Décrire une personne. 2. Des conversations à la cafeteria. 3. Des conversations avec les membres de la famille 4. Des dialogues entre les amis.		
Module:8	**Guest lecures**	**2 hours**
Guest lecures/ Natives speakers		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Fréquence jeunes-1, Méthode de français, G. Capelle et N.Gidon, Hachette, Paris, 2010.
2.	Fréquence jeunes-1, Cahier d'exercices, G. Capelle et N.Gidon, Hachette, Paris, 2010.
Reference Books	
1.	CONNEXIONS 1, Méthode de français, Régine Mérieux, Yves Loiseau, Les Éditions Didier, 2010.
2	CONNEXIONS 1, Le cahier d'exercices, Régine Mérieux, Yves Loiseau, Les Éditions Didier, 2010
3	ALTER EGO 1, Méthode de français, Annie Berthet, Catherine Hugo, Véronique M. Kizirian, Béatrix Sampsonis, Monique Waendendries, Hachette livre Paris 2011

4	ALTER EGO 1, Le cahier d'activités, Annie Berthet, Catherine Hugo, Béatrix Sampsonis, Monique Waendendries, Hachette livre, Paris 2011		
Mode of Evaluation: CAT / Assignment / Quiz / Seminar / FAT			
Recommended by Board of Studies	26-02-2016		
Approved by Academic Council	No.41	Date	17-06-2016

Course code	Course Tilte	L	T	P	J	C
FRE2001	Français Progressif	2	0	2	0	3
Pre-requisite	Français Quotidien	Syllabus version				
		1.0				

Course Objectives:

The course gives students the necessary background to:

1. understand isolated sentences and frequently used expressions in relation to immediate priority areas (personal or family information, shopping, close environment, work).
2. communicate in simple and routine tasks requiring only a simple and direct exchange of information on familiar and habitual topics.
3. enable students to describe with simply means his training, his immediate environment and evoke familiar and habitual subjects, evoke subjects that correspond to immediate needs.

Expected Course Outcome:

The students will be able to :

1. understand the expressions in French.
2. create sentences by using frequent lexicon related to himself, his family, his close environment (family, shopping, work, school, etc).
3. understand simple, clear messages on internet, authentic documents.
4. analyse predictable information in common documents, such as advertisements, flyers, menus, schedules, simple personal letters.
5. create simple and routine tasks.
6. create simple and direct exchange of information on familiar activities and topics.

Student Learning Outcomes (SLO):	2,11

Module:1	Expressions simples	8 hours

La vie quotidiennes - Le verbe pronominal - Le passé composé avec l'auxiliaire - avoir et être- le passé récent : venir de + infinitif - Le comparatif - Le superlatif - Les mots interrogatifs (les trois formes)

Savoir-faire pour : Faire des achats, faire des commandes dans un restaurant, poser des questions.

Module:2	Les activitiés quotidiennes	6 hours

La vie privée et publique (Les achats, Les voyages, les transports-La nourriture, etc.) - Les lieux de la ville - Les mots du savoir-vivre - Les pronoms indéfinis - Les pronoms démonstratifs - Les pronoms compléments objets directs/ indirects - La formation du future simple et future proche

Savoir-faire pour : Réserver les billets pour le voyage, réserver les chambres dans un hôtel, S'informer sur les lieux de la ville, indiquer la direction à un étranger.

Module:3	Les activités de loisirs	7 hours

Les loisirs (sports/spectacles/activités) - Les moments de la journée, de l'année- La fête indienne et française – Les goûts - L'impératif - La négation de l'impératif-La place du pronom à

l'impératif avec un verbe pronominal. **Savoir-faire pour :** Parler de ses goûts, raconter les vacances, formuler des phrases plus compliquées, Raconter les souvenirs de l'enfance, parler sur la tradition de son pays natal.		
Module:4	**La Francophonie**	**7 hours**
L'espace francophone - Première approche de la société française – La consommation alimentaire – caractériser un objet – décrire une tenue - Le pronom relatif (qui/que/dont/où) **Savoir-faire pour :** Articles de la presse-Portrait d'une personne-Cartes et messages d'invitation, d'acceptation ou de refus -Article de presse - rédaction d'un événement.		
Module:5	**La culture française**	**5 hours**
Parler de ses activités quotidiennes - les fêtes en France – Parler de sa famille – réserver un billet à l'agence - la gastronomie française		
Module:6	**La description**	**5 hours**
Décrire physiquement une personne – les vacances – les achats – réserver une chambre dans un hôtel – les plus grands français - raconter des évènements passés		
Module:7	**S'exprimer**	**5 hours**
Parler du climat - parcours francophone – placer une commande au restaurant –- la mode - parler de son projet d'avenir.		
Module:8	**Guest lecures**	**2 hours**
Guest lecures/ Natives speakers		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Alter Ego 1, Méthode de français, Annie Berthet, Hachette, Paris 2010.
2.	Alter Ego 1, Cahier d'exercices, Annie Berthet, Hachette, Paris 2010.
Reference Books	
1.	CONNEXIONS 1, Méthode de français, Régine Mérieux, Yves Loiseau,Les Éditions Didier, 2010.
2	CONNEXIONS 1, Le cahier d'exercices, Régine Mérieux, Yves Loiseau, Les Éditions Didier, 2010
3	Fréquence jeunes-1, Méthode de français, G. Capelle et N.Gidon, Hachette, Paris, 2010.

Mode of Evaluation: CAT / Assignment / Quiz / Project / Seminar / FAT			
Recommended by Board of Studies	26-02-2016		
Approved by Academic Council	No.41	Date	17-06-2016

Course code	Course Title	L	T	P	J	C
GER1001	Grundstufe Deutsch	2	0	0	0	2

Pre-requisite	Nil	Syllabus version
		1.0

Course Objectives:

The course gives students the necessary background to:

1. Demonstrate Proficiency in reading, writing, and speaking in basic German. Learning vocabulary related to profession, education centres, day-to-day activities, food, culture, sports and hobby, family set up, workplace, market and classroom activities are essential.
2. Make the students industry oriented and make them adapt in the German culture.

Expected Course Outcome:

The students will be able to

1. Remember greeting people, introducing oneself and understanding basic expressions in German.
2. Understand basic grammar skills to use these in a meaning way.
3. remember beginner's level vocabulary
4. Create sentences in German on a variety of topics with significant precision and in detail.
5. Apply good comprehension of written discourse in areas of special interests.

Student Learning Outcomes (SLO):	2.11

Module:1		3 hours

Begrüssung, Landeskunde, Alphabet, Personalpronomen, Verben- heissen, kommen, wohnen, lernen, Zahlen (1-100), W-Fragen, Aussagesätze, Nomen- Singular und Plural, der Artikel - Bestimmter- Unbestimmter Artikel)

Lernziel :

Sich vorstellen, Grundlegendes Verständnis von Deutsch, Deutschland in Europa

Module:2		3 hours

Konjugation der Verben (regelmässig /unregelmässig), das Jahr- Monate, Jahreszeiten und die Woche, Hobbys, Berufe, Artikel, Zahlen (Hundert bis eine Million), Ja-/Nein- Frage, Imperativ mit „Sie''

Lernziel:

Sätze schreiben, über Hobbys, Berufe erzählen, usw

Module:3		5 hours

Possessivpronomen, Negation, Kasus (Bestimmter- Unbestimmter Artikel) Trennbareverben, Modalverben, Uhrzeit, Präpositionen, Lebensmittel, Getränkeund Essen, Farben, Tiere

Lernziel :

Sätze mit Modalverben, Verwendung von Artikel, Adjektiv beim Verb		
Module:4		**5 hours**
Übersetzung: (Deutsch – Englisch / Englisch – Deutsch) **Lernziel :** Die Übung von Grammatik und Wortschatz		
Module:5		**5 hours**
Leserverständnis. Mindmap machen, Korrespondenz- Briefe und Email **Lernziel:** Übung der Sprache, Wortschatzbildung		
Module:6		**3 hours**
Aufsätze : Die Familie, Bundesländer in Deutschland, Ein Fest in Deutschland, **Lernziel :** Aktiver, selbständiger Gebrauch der Sprache		
Module:7		**4 hours**
Dialoge: a) Gespräche mit einem/einer Freund /Freundin. b) Gespräche beim Einkaufen ; in einem Supermarkt ; in einer Buchhandlung ; c) in einem Hotel - an der Rezeption ; ein Termin beim Arzt. d) Ein Telefongespräch ; Einladung–Abendessen		
Module:8		**2 hours**
Guest Lectures/ Native Speakers (Einleitung in die deustche Kultur und Politik		

	Total Lecture hours:	**30 hours**	

Text Book(s)	
1.	Netzwerk Deutsch als Fremdsprache A1, Stefanie Dengler, Paul Rusch, Helen Schmtiz, Tanja Sieber, Klett-Langenscheidt Verlag, München : 2013
Reference Books	
1.	Lagune, Hartmut Aufderstrasse, Jutta Müller, Thomas Storz, 2012.
2	Deutsche Sprachlehre für Ausländer, Heinz Griesbach, Dora Schulz, 2013
3	Studio d A1, Hermann Funk, Christina Kuhn, CorneslenVerlag, Berlin : 2010
4	Tangram Aktuell-I, Maria-Rosa, SchoenherrTil, Max Hueber Verlag, Muenchen : 2012
	www.goethe.de wirtschaftsdeutsch.de hueber.de klett-sprachen.de www.deutschtraning.org
Mode of Evaluation: CAT / Assignment / Quiz / Seminar / FAT	

Recommended by Board of Studies	04-03-2016		
Approved by Academic Council	No.41	Date	17-06-2016

Course code	Course Title	L	T	P	J	C
GER2001	**Mittelstufe Deutsch**	**2**	**0**	**2**	**0**	**3**
Pre-requisite	**Grundstufe Deutsch**	**Syllabus version**				
		1.0				

Course Objectives:

The course gives students the necessary background to:

1. Improve the communication skills in German language
2. Improve the listening and understanding capability of German FM Radio, and TV Programmes, Films
3. Build the confidence of the usage of German language and better understanding of the culture

Expected Course Outcome:

The students will be able to

1. create proficiency in advanced grammar and rules
2. Understand the texts including scientific subjects.
3. Create the ability of listening and speaking in real time situations.
4. Create the vocabulary in different context-based situations.
5. Create written communication in profession life, like replying or sending E-mails and letters in a company.
6. Create communications related to simple and routine tasks.

Student Learning Outcomes (SLO):	**2,11**

Module:1	**Proficiency in Advanced Grammar**	**8 hours**

Grammatik : Tempus- Perfekt, Präteritum, Plusquamperfekt, Futur-I, Futur-II, Wiederholung der Grundstufen grammatik

Lernziel: Sätzeschreiben in verschiedenen Zeiten.

Module:2	**Understanding of Technical Texts**	**6 hours**

Grammatik : Passiv, Personalpronomen (Nominativ, Akkusativ, Dativ)

Lernziel: Passiv, Formen des Personalpronomens

Module:3	**Understanding of Scientific texts**	**7 hours**

Adjektivdeklination, Nebensatz, Präpositionen mit Akkusativ und Dativ,
Infinitiv Sätze

Lernziel: Verbindung zwischen Adjektiv beim Nomen

Module:4	**Communicating in Real Time Situations**	**7 hours**

Übersetzung : Technische Terminologie, wissenschaftliche, literarische Texte aus dem Deutschen ins Englische und umgekehrt,

Lernziel : Übung von Grammatik und Wortschatz

Module:5	**Acquisition of the Vocabulary of the**	**5 hours**

	advanced Level	
Hörverständnis durch Audioübung : Familie, Leben in Deutschland, Am Bahnhof, Videos : Politik, Historie, Tagesablauf in eineranderen Stadt, **Lernziel** : Übung der Sprache		
Module:6	**Ability to Communicate in Professional Life**	**5 hours**
Hörverständnis durch Audioübung: Überberühmte Persönlichkeiten, Feste in Deutschland, Videos : Wetter, An der Universität, ein Zimmer buchen, Studentenleben,Städteund Landeskunde **Lernziel** : Hörverständnis, Landeskunde		
Module:7	**Ability to Communicate in Task-based Situations**	**5 hours**
Hörverständnis durch Audioübung: FM Radio aus Deutschland Videos: Fernseher aus Deutschland **Lernziel** : LSRW Fähigkeiten		
Module:8	**Invited Talk: Contemporary issues**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Text Book:1. TangramAktuell II, Rosa Maria Dallapizza, Beate Blüggel, Max Hueber Verlag ,München : 2010
Reference Books	
1.	ThemenAktuell, Heiko Bock, Mueller Jutta, MaxHueber Verla, Muenchen : 2010
2	Deutsch Sprachlehre fuer Auslaender, Schulz Griesbach, Max Hueber Verlag, Muenchen : 2012
3	Lagune, Deutsch als Fremdsprache, Jutta Müller, Storz Thomas, Hueber Verlag, Ismaning : 2013
4	Studio d A1, Hermann Funk, Christina Kuhn, Max HuerberVerlag, München : 2011

Mode of Evaluation: CAT / Assignment / Quiz / Seminar / FAT			
Recommended by Board of Studies	04-03-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Course code	Course title	L	T	P	J	C
HUM1021 / HUM1032	ETHICS AND VALUES	2	0	0	0	2
Pre-requisite	Nil	Syllabus version				
		1.1				

Course Objectives:

1. To understand and appreciate the ethical issues faced by an individual in profession, society and polity
2. To understand the negative health impacts of certain unhealthy behaviors
3. To appreciate the need and importance of physical, emotional health and social health

Expected Course Outcome:

Students will be able to:

1. Follow sound morals and ethical values scrupulously to prove as good citizens
2. Understand various social problems and learn to act ethically
3. Understand the concept of addiction and how it will affect the physical and mental health
4. Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
5. Identify the main typologies, characteristics, activities, actors and forms of cybercrime

Student Learning Outcomes (SLO):	2,10,11,12

Module:1	Being Good and Responsible	5 hours

Gandhian values such as truth and non-violence – Comparative analysis on leaders of past and present – Society's interests versus self-interests - Personal Social Responsibility: Helping the needy, charity and serving the society

Module:2	Social Issues 1	4 hours

Harassment – Types - Prevention of harassment, Violence and Terrorism

Module:3	Social Issues 2	4 hours

Corruption: Ethical values, causes, impact, laws, prevention – Electoral malpractices;
White collar crimes - Tax evasions – Unfair trade practices

Module:4	Addiction and Health	5 hours

Peer pressure - Alcoholism: Ethical values, causes, impact, laws, prevention – Ill effects of smoking - Prevention of Suicides;
Sexual Health: Prevention and impact of pre-marital pregnancy and Sexually Transmitted Diseases

Module:5	Drug Abuse	3 hours

Abuse of different types of legal and illegal drugs: Ethical values, causes, impact, laws and prevention

Module:6	**Personal and Professional Ethics**	**4 hours**	
Dishonesty - Stealing - Malpractices in Examinations – Plagiarism			
Module:7	**Abuse of Technologies**	**3 hours**	
Hacking and other cyber crimes, Addiction to mobile phone usage, Video games and Social networking websites			
Module:8	**Contemporary issues:**	**2 hours**	
Guest lectures by Experts			
	Total Lecture hours:	**30 hours**	

Reference Books

1. Dhaliwal, K.K , "Gandhian Philosophy of Ethics: A Study of Relationship between his Presupposition and Precepts,2016, Writers Choice, New Delhi, India.
2. Vittal, N, "Ending Corruption? - How to Clean up India?", 2012, Penguin Publishers, UK.
3. Pagliaro, L.A. and Pagliaro, A.M, "Handbook of Child and Adolescent Drug and Substance Abuse: Pharmacological , Developmental and Clinical Considerations",
4. 2012Wiley Publishers, U.S.A.
Pandey, P. K (2012), "Sexual Harassment and Law in India", 2012, Lambert Publishers, Germany.

Mode of Evaluation: CAT, Assignment, Quiz, FAT and Seminar			
Recommended by Board of Studies	26-07-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

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Course Code	Course Title	L	T	P	J	C
MAT-1011	Calculus for Engineers	3	0	2	0	4
Pre-requisite	10+2 Mathematics or MAT1001	Syllabus Version				
		1.0				

Course Objectives:

1. To provide the requisite and relevant background necessary to understand the other important engineering mathematics courses offered for Engineers and Scientists.
2. To introduce important topics of applied mathematics, namely Single and Multivariable Calculus and Vector Calculus are introduced.
3. To impart the knowledge of Laplace transform, an important transform technique for Engineers which requires knowledge of integration

Expected Course Outcome

At the end of this course the students are expected to learn

1. How to apply single integrals to find the area and volume by using the techniques of definite integrals and improper integrals
2. How to find the maxima and minima for functions involving single or several variables
3. How to evaluate multiple integrals in Cartesian, Cylindrical and Spherical geometries.
4. The powerful language of Vector calculus with physical understanding to deal with subjects such as Fluid Dynamics and Electromagnetic fields.
5. Use of Laplace Transform Techniques in Signal analysis

Student Learning Outcomes (SLO):	1,2,9

Module:1	Applications of Single Variable Differentiation and Integration	9 hours

Differentiation- Extrema on an Interval-Rolle's Theorem and the Mean Value Theorem-Increasing and Decreasing functions and First derivative test-Second derivative test-Maxima and Minima-Concavity. Integration-Average function value - Area between curves - Volumes of solids of revolution - Beta and Gamma functions–interrelation

Module:2	Laplace transforms	7 hours

Definition of Laplace transform-Properties-Laplace transform of periodic functions-Laplace transform of unit step function, Impulse function-Inverse Laplace transform-Convolution.

Module:3	Multivariable Calculus	4 hours

Functions of two variables-limits and continuity-partial derivatives –total differential-Jacobian and it Prosperities.

Module:4	Applications of Multivariable Calculus	5hours

Taylor's expansion for two variables–maxima and minima–constrained maxima and minima-

Lagrange's multiplier method.		
Module:5	**Multiple integrals**	**8 hours**
Evaluation of double integrals–change of order of integration–change of variables between Cartesian and polar co-ordinates- - Evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical co-ordinates- -evaluation of multiple integrals using gamma and beta functions.		
Module:6	**Vector Differentiation**	**5 hours**
Scalar and vector valued functions – gradient, tangent plane–directional derivative-divergence and curl–scalar and vector potentials–Statement of vector identities-Simple problems		
Module:7	**Vector Integration**	**5 hours**
line, surface and volume integrals - Statement of Green's, Stoke's and Gauss divergence theorems -verification and evaluation of vector integrals using them.		
Module:8	**Contemporary Issues:**	**2 hours**
Industry Expert Lecture		
	Total Lecture hours:	**45 hours**

Text Book(s)

1. Thomas' Calculus by George B.Thomas, D.Weir and J.Hass, 13th edition 2014, Pearson.
2. Advanced Engineering Mathematics by Erwin Kreyszig, 10th Edition, John Wiley India, 2015

Reference Books

1. Higher Engineering Mathematics by B.S. Grewal, 43rd Edition ,Khanna Publishers, India,2015
2. Higher Engineering Mathematics by John Bird, 5th Edition, Elsevier Limited, 2006.
3. Calculus: Early Transcendentals by James Stewart, 8th edition, Cengage Learning, 2014.
4. K.A.Stroud and Dexter J. Booth, Engineering Mathematics, 6th Edition, Palgrave Macmillan (2007)

Mode of Evaluation

Digital Assignments, Quiz, Continuous Assessments, Final Assessment Test

List of Challenging Experiments (Indicative)		**SLO:** 1, 2, 9
1.	Introduction to MATLAB through matrices, and general Syntaxes,	2 hours
2	Plotting and visualizing curves and surfaces in MATLAB – Symbolic computations using MATLAB	2 hours
3.	Evaluating Extremum of a single variable function	2 hours
4.	Understanding integration as Area under the curve	2 hours
5.	Evaluation of Volume by Integrals (Solids of Revolution)	2 hours
6.	Evaluating Maxima and minima of functions of several variables	2 hours
7.	Applying Lagrange multiplier optimization method	2 hours
8.	Evaluating Volume under surfaces	2 hours

9.	Evaluating triple integrals			2 hours
10.	Evaluating gradient, curl and divergence			2 hours
11.	Evaluating line integrals in vectors			2 hours
12.	Applying Greens theorem to real world problems			2 hours
Total Laboratory Hours				24 hours
Recommended by Board of Studies	25-02-2017			
Approved by Academic Council	No. 45	Date	16-03-2017	

Course Code	Course Title	L	T	P	J	C
MAT-2001	Statistics for Engineers	2	1	2	0	4
Pre-requisite	MAT1011 - Calculus for Engineers	Syllabus Version				
		1.0				

Course Objectives:

1. To provide students with a framework that will help them choose the appropriate descriptive methods in various data analysis situations.
2. To analyse distributions and relationships of real-time data.
3. To apply estimation and testing methods to make inference and modeling techniques for decision making.

Expected Course Outcome

At the end of this course the students are expected to

1. Have an understanding of the probability concepts.
2. Analyze the problems connected with statistics and reliability.
3. Understand how to make the transition from a real problem to a probability model for that problem. The most desirable is to expose students to practical applications of expectation and probability that provide the proper tools for handling the design of the system that involve randomness.

Student Learning Outcomes (SLO):	1,2,7

Module:1	Introduction to Statistics	6 hours

Introduction to statistics and data analysis-Measures of central tendency –Measures of variability-[Moments-Skewness-Kurtosis (Concepts only)].

Module:2	Random variables	8 hours

Introduction -random variables-Probability mass Function, distribution and density functions - joint Probability distribution and joint density functions- Marginal, conditional distribution and density functions- Mathematical expectation, and its properties Covariance , moment generating function – characteristic function.

Module:3	Correlation and regression:	4 hours

Correlation and Regression – Partial and Multiple correlation- Multiple regression.

Module:4	Probability Distributions	7hours

Binomial and Poisson distributions – Normal distribution – Gamma distribution – Exponential distribution – Weibull distribution

Module:5	Hypothesis Testing I	4 hours

Testing of hypothesis – Introduction-Types of errors, critical region, procedure of testing hypothesis- Large sample tests- Z test for Single Proportion, Difference of Proportion, mean and

difference of means.		
Module:6	**Hypothesis Testing II**	**9 hours**
Small sample tests- Student's t-test, F-test- chi-square test- goodness of fit - independence of attributes- Design of Experiments - Analysis of variance – one and two way classifications - CRD-RBD- LSD.		
Module:7	**Reliability**	**5 hours**
Basic concepts- Hazard function-Reliabilities of series and parallel systems- System Reliability - Maintainability-Preventive and repair maintenance- Availability.		
Module:8	**Contemporary Issues**	**2 hours**
Industry Expert Lecture		
	Total Lecture hours:	**45 hours**
Text Book(s)		
3. Probability and Statistics for engineers and scientists by R.E.Walpole, R.H.Mayers, S.L.Mayers and K.Ye, 9th Edition, Pearson Education (2012). 4. Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, (2016), John Wiley & Sons; 6th Edition.		
Reference Books		
Reliability Engineering by E.Balagurusamy, Tata McGraw Hill, Tenth reprint 2010. Probability and Statistics by J.L.Devore, 8th Edition, Brooks/Cole, Cengage Learning (2012). Probability and Statistics for Engineers by R.A.Johnson, Miller & Freund's, 8th edition, Prentice Hall India (2011) Probability, Statistics and Reliability for Engineers and Scientists by Bilal M. Ayub and Richard H. McCuen, 3rd edition, CRC press (2011).		
Mode of Evaluation		
Digital Assignments (Solutions by using soft skills), Continuous Assessment Tests, Quiz, Final Assessment Test.		
List of Challenging Experiments (Indicative)		**SLO: 1, 2, 7**
1.	Introduction: Understanding Data types; importing/exporting data.	2 hours
2	Computing Summary Statistics /plotting and visualizing data using Tabulation and Graphical Representations.	2 hours
3.	Applying correlation and simple linear regression model to real dataset; computing and interpreting the coefficient of determination	2 hours
4.	Applying multiple linear regression model to real dataset; computing and interpreting the multiple coefficient of determination	2 hours
5.	Fitting the following probability distributions: Binomial distribution,	2 hours
6.	Normal distribution Poisson distribution	2 hours
7.	Testing of hypothesis for One sample mean and proportion from real-time problems.	2 hours
8.	Testing of hypothesis for Two sample mean and proportion from real-time problems	2 hours
9.	Applying the t test for independent and dependent samples	2 hours
10.	Applying Chi-square test for goodness of fit test and Contingency test to	2 hours

	real dataset			
11.	Performing ANOVA for real dataset for Completely randomized design, Randomized Block design ,Latin square Design			2 hours
Total Laboratory Hours				22 hours
Weekly Assessment, Final Assessment Test				
Recommended by Board of Studies	25-02-2017			
Approved by Academic Council	No. 45	Date	16-03-2017	

Course Code	Course Title	L	T	P	J	C
MGT1022	Lean Start-up Management	1	0	0	4	2
Pre–Requisite	None	Syllabus version				
		1.0				

Unit	Topics	Hours
1	Creativity and Design Thinking (identify the vertical for business opportunity, understand your customers, accurately assess market opportunity)	2
2	Minimum Viable Product (Value Proposition, Customer Segments, Build-measure-learn process)	3
3	Business Model Development(Channels and Partners, Revenue Model and streams, Key Resources, Activities and Costs, Customer Relationships and Customer Development Processes, Business model canvas –the lean model-templates)	3
4	Business Plan and Access to Funding(visioning your venture, taking the product/ service to market, Market plan including Digital & Viral Marketing, start-up finance - Costs/Profits & Losses/cash flow, Angel/VC,/Bank Loans and Key elements of raising money)	3
5	Legal, Regulatory, CSR, Standards, Taxes	2
6	Lectures by Entrepreneurs	2
	Total Lecture Hours	**15**

Teaching Modes	Assignments; Field Trips, Case Studies; e-learning; Learning through research, TED Talks

Text Books

1. The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company, Steve Blank, K & S Ranch; 1st edition (March 1, 2012)
2.The Four Steps to the Epiphany, Steve Blank, K&S Ranch; 2nd edition (July 17, 2013)
3. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Crown Business; (13 September 2011)

Reference Books

1. Holding a Cat by the Tail, Steve Blank, K&S Ranch Publishing LLC (August 14, 2014)
2. Product Design and Development, Karal T Ulrich, SD Eppinger, McGraw Hill
3. Zero to One: Notes on Startups, or How to Build the Future, Peter Thiel, Crown Business; (16 September 2014)
4. Lean Analytics: Use Data to Build a Better Startup Faster (Lean Series), Alistair Croll & Benjamin Yoskovitz, O'Reilly Media; 1st Edition (March 21, 2013)
5. Inspired: How To Create Products Customers Love, Marty Cagan, SVPG Press; 1st edition (June 18, 2008)

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Course code	Course title	L	T	P	J	C
PHY1701	Engineering Physics	3	0	2	0	4
Pre-requisite	Physics of 12th standard or equivalent.	Syllabus version				
		1.1				

Course Objectives:

1. Having an ability to apply mathematics and science in engineering applications
2. Having a clear understanding of the subject related concepts and of contemporary issues
3. Having Sense-Making Skills of creating unique insights in what is being seen or observed (Higher level thinking skills which cannot be codified)

Expected Course Outcome:

1. Comprehend the dual nature of radiation and matter.
2. Compute Schrodinger's equations to solve finite and infinite potential problems.
3. Analyze quantum ideas at the nanoscale.
4. Apply quantum ideas for understanding the operation and working principle of optoelectronic devices.
5. Recall the Maxwell's equations in differential and integral form.
6. Design the various types of optical fibers for different Engineering applications.
7. Explain concept of Lorentz Transformation for Engineering applications.
8. 8. Demonstrate the quantum mechanical ideas

Student Learning Outcomes (SLO):	2,4,5,9

Module:1	Introduction to Modern Physics	6 hours

Planck's concept (hypothesis), Compton Effect, Particle properties of wave: Matter Waves, Davisson Germer Experiment, Heisenberg Uncertainty Principle, Wave function, and Schrodinger equation (time dependent & independent).

Module:2	Applications of Quantum Physics	5 hours

Particle in a 1-D box (Eigen Value and Eigen Function), 3-D Analysis (Qualitative), Tunneling Effect (Qualitative) , Scanning Tunneling Microscope (STM).

Module:3	Nanophysics	5 hours

Introduction to Nano-materials, Moore's law, Properties of Nano-materials, Quantum confinement, Quantum well, wire & dot, Carbon Nano-tubes (CNT), Applications of nanotechnology in industry.

Module:4	Laser Principles and Engineering Application	6 hours

Laser Characteristics, Spatial and Temporal Coherence, Einstein Coefficient & its significance, Population inversion, Two, three & four level systems, Pumping schemes, Threshold gain coefficient, Components of laser, Nd-YAG, He-Ne, CO2 and Dye laser and their engineering applications.		
Module:5	**Electromagnetic Theory and its application**	**6 hours**
hysics of Divergence, Gradient and Curl, Qualitative understanding of surface and volume integral, Maxwell Equations (Qualitative), Wave Equation (Derivation), EM Waves, Phase velocity, Group velocity, Group index , Wave guide (Qualitative)		
Module:6	**Propagation of EM waves in Optical fibers**	**6 hours**
Light propagation through fibers, Acceptance angle, Numerical Aperture, Types of fibers - step index, graded index, single mode & multimode, Attenuation, Dispersion-intermodal and intramodal.		
Module:7	**Optoelectronic Devices & Applications of Optical fibers**	**9 hours**
Sources-LED & Laser Diode, Detectors-Photodetectors- PN & PIN - Applications of fiber optics in communication- Endoscopy. Special Theory of Relativity: Frame of reference, Galilean relativity, Postulate of special theory of relativity, Simultaneity, length contraction and time dilation.		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industry Experts		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Concepts of Modern Physics, Arthur Besier, Shobhit Mahajan, S. Rai Choudhury, 7th Edition, Mcgraw Hill Education, New Delhi, 2015
2.	Laser Fundamentals, William Silfvast, 2nd edition, Cambridge University Press, Cambridge, 2008 [Classic Book on the subject of Lasers]
3.	Introduction to Electrodynamics, D. J. Griffith, 3rd Edition, Addison-Wesley Professional, Boston, 2012
4.	Fiber Optic Communication Technology, Djafar K. Mynbaev and Lowell L. Scheiner, Addison Wesley Longman, Singapore, 2011
Reference Books	

1.	Modern Physics, Raymond A. Serway, Clement J. Mosses, Curt A. Moyer, 3rd Edition, Cengage learning, Boston, 2010
2.	Laser Systems and Applications, Nityanand Choudhary and Richa Verma, PHI Learning Private Ltd., New Delhi, 2011
3.	Principles of Electromagnetics, Matthew N.O. Sadiku, 4th Edition, Oxford, New Delhi, 2010
4.	Introduction to Fiber Optics, Ajoy Ghatak and K. Thyagarajan, Cambridge University Press, New Delhi, 2010

Mode of Evaluation: Quizzes, Digital Assignments, CAT-I and II and FAT

Recommended by Board of Studies: 11.08.2017			
Approved by Academic Council	No. 46	Date	24.08.2017

List of Challenging Experiments (Indicative)

1.	Determination of Planck's constant using electroluminescence process (Module 1)	2 hours
2.	Electron diffraction (Module 1)	2 hours
3.	Determination of wavelength of laser source (He -Ne laser and diode lasers of different wavelengths) using diffraction technique (Module 4)	2 hours
4.	Dispersive power of prism (Module 6)	2 hours
5.	Optical Fiber communication (source + optical fiber + detector) (Modules 7+8)	2 hours
6.	Determination of size of fine particle using laser diffraction (Module 3)	2 hours
7.	Determination of the track width (periodicity) in a written CD (Module 4)	2 hours
8.	PIN diode characteristics (Module 8)	2 hours
9.	Black body Radiation (Module 1+2)	2 hours
10.	Optical Fiber communication (source + optical fiber + detector) (Modules 7 + 8)	2 hours
11.	Analysis of crystallite size and strain in a nano -crystalline film using X-ray diffraction (Module 3)	2 hours
12.	Numerical solutions of Schrödinger equation (e.g. particle in a box problem) (Module 2) (can be given as an assignment)	2 hours
13.	Laser coherence length measurement (Module 4)	2 hours
14.	Proof for transverse nature of E.M. waves (Module 6)	2 hours
15.	Quantum confinement and Heisenberg's uncertainty principle (Module 1 + 3)	2 hours
	Total Laboratory Hours	30 hours

Mode of Evaluation : CAT/FAT

Recommended by Board of Studies	11-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Course code	Course title	L	T	P	J	C
PHY1999	Introduction to Innovative Projects	1	0	0	4	2
Pre-requisite	None	Syllabus version				
		1.0				

Course Objectives:

This course is offered to the students in the 1st Year of B.Tech. in order to orient them towards independent, systemic thinking and be innovative.

1. To make students confident enough to handle the day to day issues.
2. To develop the "Thinking Skill" of the students, especially Creative Thinking Skills
3. To train the students to be innovative in all their activities
4. To prepare a project report on a socially relevant theme as a solution to the existing issues

Expected Course Outcome: Students will be able to

1. Comprehend the various types of thinking skills.
2. Explain the innovative and creative ideas.
3. Analyze a suitable solution for socially relevant issues

Student Learning Outcomes (SLO):	2,3,9,17,18

2.Having a clear understanding of the subject related concepts and of contemporary issues
3. Having an ability to be socially intelligent with good SIQ (Social Intelligence Quotient) and EQ (Emotional Quotient)
9. Having problem solving ability- solving social issues and engineering problems
17. Having an ability to use techniques, skills and modern engineering tools necessary for engineering practice
18. Having critical thinking and innovative skills

Module:1 A	Self Confidence	1 hour

Understanding self – Johari Window –SWOT Analysis – Self Esteem – Being a contributor – Case Study

Project : Exploring self, understanding surrounding, thinking about how s(he) can be a contributor for the society, Creating a big picture of being an innovator – writing a 1000 words imaginary autobiography of self – Topic "Mr X – the great innovator of 2015" and upload. **(4 non- contact hours)**

Module:1 B	Thinking Skill	1 hour

Thinking and Behaviour – Types of thinking– Concrete – Abstract, Convergent, Divergent, Creative, Analytical, Sequential and Holistic thinking – Chunking Triangle – Context Grid – Examples – Case Study.

Project : Meeting at least 50 people belonging to various strata of life and talk to them / make field visits to identify a min of100 society related issues, problems for which they need solutions and categories them and upload along with details of people met and lessons learnt. **(4 non- contact hours)**

Module:1 C	Lateral Thinking Skill	1 hour

Blooms Taxonomy – HOTS – Outof the box thinking – deBono lateral thinking model – Examples **Project :** Last weeks - incomplete portion to be done and uploaded		
Module:2 A	**Creativity**	**1 hour**
Creativity Models – Walla – Barrons – Koberg & Begnall – Examples **Project:** Selecting 5 out of 100 issues identified for future work. Criteria based approach for prioritisation, use of statistical tools & upload . **(4 non- contact hours)**		
Module:2 B	**Brainstorming**	**1 hour**
25 brainstorming techniques and examples **Project :** Brainstorm and come out with as many solutions as possible for the top 5 issues identified & upload . **(4 non- contact hours)**		
Module:3	**Mind Mapping**	**1 hour**
Mind Mapping techniques and guidelines. Drawing a mind map **Project :** Using Mind Maps get another set of solutions forthe next 5 issues (issue 6 – 10) . **(4 non- contact hours)**		
Module:4 A	**Systems thinking**	**1 hour**
Systems Thinking essentials – examples – Counter Intuitive condemns **Project :** Select 1 issue / problem for which the possible solutions are available with you. Apply Systems Thinking process and pick up one solution [explanation should be given why the other possible solutions have been left out]. Go back to the customer and assess the acceptability and upload. . **(4 non- contact hours)**		
Module:4 B	**Design Thinking**	**1 hour**
Design thinking process – Human element of design thinking – case study **Project :** Apply design thinking to the selected solution, apply the engineering & scientific tinge to it. Participate in "design week" celebrations upload the weeks learning out come.		
Module:5 A	**Innovation**	**1 hour**
Difference between Creativity and Innovation – Examples of innovation –Being innovative. **Project:** A literature searches on prototyping of your solution finalized. Prepare a prototype model or process and upload. . **(4 non- contact hours)**		
Module:5 B	**Blocks for Innovation**	**1 hour**
Identify Blocks for creativity and innovation – overcoming obstacles – Case Study **Project :** Project presentation on problem identification, solution, innovations-expected results – Interim review with PPT presentation. . **(4 non- contact hours)**		
Module:5 C	**Innovation Process**	**1 hour**
Steps for Innovation – right climate for innovation **Project:** Refining the project, based on the review report and uploading the text. . **(4 non- contact hours)**		
Module:6 A	**Innovation in India**	**1 hour**
Stories of 10 Indian innovations **Project:** Making the project better with add ons. . **(4 non- contact hours)**		
Module:6 B	**JUGAAD Innovation**	**1 hour**
Frugal and flexible approach to innovation - doing more with less Indian Examples **Project:** Fine tuning the innovation project with JUGAAD principles and uploading (Credit for JUGAAD implementation) . **(4 non- contact hours)**		

Module:7 A	**Innovation Project Proposal Presentation**	**1 hour**
Project proposal contents, economic input, ROI – Template **Project:** Presentation of the innovative project proposal and upload . **(4 non- contact hours)**		
Module:8 A	Contemporary issue in Innovation	**1 hour**
Contemporary issue in Innovation **Project:** Final project Presentation , Viva voce Exam (**4 non- contact hours)**		
	Total Lecture hours:	**15 hours**

Text Book(s)

1.	How to have Creative Ideas, Edward debone, Vermilon publication, UK, 2007
2.	The Art of Innovation, Tom Kelley & Jonathan Littman, Profile Books Ltd, UK, 2008

Reference Books

1.	Creating Confidence, Meribeth Bonct, Kogan Page India Ltd, New Delhi, 2000
2.	Lateral Thinking Skills, Paul Sloane, Keogan Page India Ltd, New Delhi, 2008
3.	Indian Innovators, Akhat Agrawal, Jaico Books, Mumbai, 2015
4.	JUGAAD Innovation, Navi Radjou, Jaideep Prabhu, Simone Ahuja Random house India, Noida, 2012.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Three reviews with weightage of 25 : 25 : 50 along with reports

Recommended by Board of Studies	15-12-2015		
Approved by Academic Council	No. 39	Date	17-12-2015

VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Soft Skills Course Basket

Course code	Course title	L	T	P	J	C
STS1001	Introduction to Soft skills	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. To enhance the ability to plan better and work as a team effectively
2. To boost the learning ability and to acquire analytical and research skills
3. To educate the habits required to achieve success

Expected Course Outcome:

- Enabling students to know themselves and interact better with self and environment

Student Learning Outcomes (SLO):	10,12

10**.** Having a clear understanding of professional and ethical responsibility

12. Having adaptive thinking and adaptability

Module:1	Lessons on excellence	10 hours

Ethics and integrity

Importance of ethics in life, Intuitionism vs Consequentialism, Non-consequentialism, Virtue ethics vs situation ethics, Integrity - listen to conscience, Stand up for what is right

Change management

Who moved my cheese?, Tolerance of change and uncertainty, Joining the bandwagon, Adapting change for growth - overcoming inhibition

How to pick up skills faster?

Knowledge vs skill, Skill introspection, Skill acquisition, "10,000 hours rule" and the converse

Habit formation

Know your habits, How habits work? - The scientific approach, How habits work? - The psychological approach, Habits and professional success, "The Habit Loop", Domino effect, Unlearning a bad habit

Analytic and research skills.

Focused and targeted information seeking, How to make Google work for you, Data assimilation

Module:2	Team skills	11 hours

Goal setting

SMART goals, Action plans, Obstacles -Failure management

Motivation

Rewards and other motivational factors, Maslow's hierarchy of needs, Internal and external motivation

Facilitation

Planning and sequencing, Challenge by choice, Full Value Contract (FVC), Experiential learning cycle, Facilitating the Debrief

Introspection

Identify your USP, Recognize your strengths and weakness, Nurture strengths, Fixing weakness, Overcoming your complex, Confidence building

Trust and collaboration

Virtual Team building, Flexibility, Delegating, Shouldering responsibilities

Module:3	**Emotional Intelligence**	**12 hours**

Transactional Analysis

Introduction**,** Contracting, Ego states**,** Life positions

Brain storming

Individual Brainstorming, Group Brainstorming, Stepladder Technique, Brain writing, Crawford's Slip writing approach, Reverse brainstorming, Star bursting, Charlette procedure, Round robin brainstorming

Psychometric Analysis

Skill Test, Personality Test

Rebus Puzzles/Problem Solving

More than one answer, Unique ways

Module:4	**Adaptability**	**12 hours**

Theatrix

Motion Picture, Drama, Role Play, Different kinds of expressions

Creative expression

Writing, Graphic Arts, Music, Art and Dance

Flexibility of thought

The 5'P' framework (Profiling, prioritizing, problem analysis, problem solving, planning)

Adapt to changes(tolerance of change and uncertainty)

Adaptability Curve , Survivor syndrome

	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	Chip Heath, How to Change Things When Change Is Hard (Hardcover**)**,2010,First Edition,Crown Business.
2.	Karen Kindrachuk, Introspection**,** 2010, 1st Edition.
3.	Karen Hough, The Improvisation Edge: Secrets to Building Trust and Radical Collaboration at Work, 2011, Berrett-Koehler Publishers
Reference Books	
1.	Gideon Mellenbergh, A Conceptual Introduction to Psychometrics: Development, Analysis and Application of Psychological and Educational Tests,2011, Boom Eleven International.
2.	Phil Lapworth, An Introduction to Transactional Analysis, 2011, Sage Publications (CA)

Mode of Evaluation: FAT, Assignments, Projects, Case studies, Role plays,3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies	09/06/2017		
Approved by Academic Council	No. 45th AC	Date	15/06/2017

Course code	Course title	L	T	P	J	C
STS1002	Introduction to Business Communication	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2				

Course Objectives:

1. To provide an overview of Prerequisites to Business Communication
2. To enhance the problem solving skills and improve the basic mathematical skills
3. To organize the thoughts and develop effective writing skills

Expected Course Outcome:

- Enabling students enhance knowledge of relevant topics and evaluate the information

Student Learning Outcomes (SLO): **9, 11**

9. Having problem solving ability- solving social issues and engineering problems

11. Having interest in lifelong learning

Module:1	Study skills	10 hours

Memory techniques

Relation between memory and brain, Story line technique, Learning by mistake, Image-name association, Sharing knowledge, Visualization

Concept map

Mind Map, Algorithm Mapping, Top down and Bottom Up Approach

Time management skills

Prioritization - Time Busters, Procrastination, Scheduling, Multitasking, Monitoring

6. Working under pressure and adhering to deadlines

Module:2	Emotional Intelligence (Self Esteem)	6 hours

Empathy

Affective Empathy and Cognitive Empathy

Sympathy

Level of sympathy (Spatial proximity, Social Proximity, Compassion fatigue)

Module:3	Business Etiquette	9 hours

Social and Cultural Etiquette

Value, Manners, Customs, Language, Tradition

Writing Company Blogs

Building a blog, Developing brand message, FAQs', Assessing Competition

Internal Communications

Open and objective Communication, Two way dialogue, Understanding the audience

Planning

Identifying, Gathering Information, Analysis, Determining, Selecting plan, Progress check, Types of planning

Writing press release and meeting notes

Write a short, catchy headline, Get to the Point –summarize your subject in the first paragraph, Body – Make it relevant to your audience

Module:4	**Quantitative Ability**	**4 hours**

Numeracy concepts

Fractions, Decimals, Bodmas, Simplifications, HCF, LCM, Tests of divisibility

Beginning to Think without Ink

Problems solving using techniques such as: Percentage, Proportionality, Support of answer choices, Substitution of convenient values, Bottom-up approach etc.

Math Magic

Puzzles and brain teasers involving mathematical concepts

Speed Calculations

Square roots, Cube roots, Squaring numbers, Vedic maths techniques

Module:5	**Reasoning Ability**	**3 hours**

Interpreting Diagramming and sequencing information

Picture analogy, Odd picture, Picture sequence, Picture formation, Mirror image and water image

Logical Links

Logic based questions-based on numbers and alphabets

Module:6	**Verbal Ability**	**3 hours**

S**trengthening Grammar Fundamentals**

Parts of speech, Tenses, Verbs(Gerunds and infinitives)

Reinforcements of Grammar concepts

Subject Verb Agreement, Active and Passive Voice, Reported Speech

Module:7	**Communication and Attitude**	**10 hours**

Writing

Writing formal & informal letters, How to write a blog & knowing the format, Effective ways of writing a blog, How to write an articles & knowing the format, Effective ways of writing an articles, Designing a brochures

Speaking skills

How to present a JAM, Public speaking

Self managing

Concepts of self management and self motivation, Greet and Know, Choice of words, Giving feedback, Taking criticism

	Total Lecture hours:	**45 hours**	

Text Book(s)

1.	FACE, Aptipedia, Aptitude Encyclopedia, 2016, First Edition, Wiley Publications, Delhi.
2.	ETHNUS, Aptimithra, 2013, First Edition, McGraw-Hill Education Pvt. Ltd.

Reference Books

1.	Alan Bond and Nancy Schuman, 300+ Successful Business Letters for All Occasions, 2010, Third Edition, Barron's Educational Series, New York.
2.	Josh Kaufman, The First 20 Hours: How to Learn Anything ... Fast , 2014, First Edition, Penguin Books, USA.

Mode of Evaluation: FAT, Assignments, Projects, Case studies, Role plays,
3 Assessments with Term End FAT (Computer Based Test)

Recommended by Board of Studies	09/06/2017		
Approved by Academic Council	No. 45th AC	Date	15/06/2017

Course code	Course Title	L	T	P	J	C
STS 1101	Fundamentals of Aptitude	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. To enhance the logical reasoning skills of the students and improve the problem-solving abilities
2. To strengthen the ability to solve quantitative aptitude problems
3. To enrich the verbal ability of the students

Expected Course Outcome:

1. Students will be introduced to basic concepts of Quantitative Aptitude, Logical reasoning and Verbal ability
2. Students will be able to read and demonstrate good comprehension of text in areas of the student's interest
3. Students will be able to demonstrate the ability to resolve problems that occur in their field.

Student Learning Outcomes (SLO):	5, 9, 10, 12 and 16

Module:1	Lessons on excellence	2hours

Skill introspection, Skill acquisition, consistent practice

Module:2	Logical Reasoning	16 hours

Thinking Skill

- Problem Solving
- Critical Thinking
- Lateral Thinking

Taught through thought-provoking word and rebus puzzles, and word-link builder questions

Coding & decoding, Series, Analogy, Odd man out and Visual reasoning

- Coding and Decoding
- Series
- Analogy
- Odd Man Out
- Visual Reasoning

Sudoku puzzles

Solving introductory to moderate level sudoku puzzles to boost logical thinking and comfort with numbers

Attention to detail

Picture and word driven Qs to develop attention to detail as a skill

Module:3	**Quantitative Aptitude**	**14 hours**

Speed Maths

- Addition and Subtraction of bigger numbers
- Square and square roots
- Cubes and cube roots
- Vedic maths techniques
- Multiplication Shortcuts
- Multiplication of 3 and higher digit numbers
- Simplifications
- Comparing fractions
- Shortcuts to find HCF and LCM
- Divisibility tests shortcuts

Algebra and functions

Module:4	**Recruitment Essentials**	**5hours**

Looking at an engineering career through the prism of an effective resume

- Importance of a resume - the footprint of a person's career achievements
- How a resume looks like?
- An effective resume vs. a poor resume: what skills you must build starting today and how?

Impression Management

Getting it right for the interview:

- Grooming, dressing
- Body Language and other non-verbal signs
- Displaying the right behaviour

Module:5	**Verbal Ability**	**8hours**

Essential grammar for placements:

- Nouns and Pronouns
- Verbs
- Subject-Verb Agreement
- Pronoun-Antecedent Agreement
- Punctuations

Verbal Reasoning

	Total Lecture hours:	**45 hours**

Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

Text Book(s):

1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.
2. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd.
3. **SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press.**
4. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.

Reference Book(s):

Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.

Course code	Course title	L	T	P	J	C
STS 1102	Arithmetic problem solving	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. To enhance the logical reasoning skills of the students and improve the problem-solving abilities
2. To strengthen the ability to solve quantitative aptitude problems
3. To enrich the verbal ability of the students for academic purpose

Expected course outcome:

1. Students will be able to show more confidence in solving problems of Quantitative Aptitude
2. Students will be able to show more confidence in solving problems of Logical Reasoning
3. Students will be able to show more confidence in understanding the questions of Verbal Ability

Student Learning Outcomes (SLO):	5, 9 and 16

Module:1	Logical Reasoning	11 hours

Word group categorization questions

Puzzle type class involving students grouping words into right group orders of logical sense

Cryptarithmetic

Data arrangements and Blood relations

- Linear Arrangement
- Circular Arrangement
- Multi-dimensional Arrangement
- Blood Relations

Module:2	Quantitative Aptitude	18 hours

Ratio and Proportion

- Ratio
- Proportion
- Variation
- Simple equations
- Problems on Ages
- Mixtures and alligations

Percentages, Simple and Compound Interest

- Percentages as Fractions and Decimals
- Percentage Increase / Decrease

- Simple Interest
- Compound Interest
- Relation Between Simple and Compound Interest

Number System

- Number system
- Power cycle
- Remainder cycle
- Factors, Multiples
- HCF and LCM

Module:3	**Verbal Ability**	**16hours**

Essential grammar for placements

- Prepositions
- Adjectives and Adverbs
- Tenses
- Forms and Speech and Voice
- Idioms and Phrasal Verbs
- Collocations, Gerund and Infinitives

Reading Comprehension for placements

- Types of questions
- Comprehension strategies
- Practice exercises

Articles, Prepositions and Interrogatives

- Definite and Indefinite Articles
- Omission of Articles
- Prepositions
- Compound Prepositions and Prepositional Phrases
- Interrogatives

Vocabulary for placements

- Exposure to solving questions of
- Synonyms
- Antonyms
- Analogy
- Confusing words
- Spelling correctness

	Total Lecture hours:	**45 hours**

Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

Text Book(s):

5. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.
6. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd.
7. **SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press.**
8. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.

Reference Book(s):

Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.

	Course title	L	T	P	J	C
STS 1201	**Introduction to problem solving**	**3**	**0**	**0**	**0**	**1**
Pre-requisite	**None**	**Syllabus version**				
		1				

Course Objectives:

1. To enhance the logical reasoning skills of the students and improve the problem-solving abilities
2. To strengthen the ability to solve quantitative aptitude problems
3. To enrich the verbal ability of the students for academic purpose

Expected Course Outcome:

1. Students will be introduced to basic concepts of Quantitative Aptitude, Logical reasoning and Verbal ability
2. Students will be able to read and demonstrate good comprehension of text in areas of the student's interest
3. Students will be able to demonstrate the ability to resolve problems that occur in their field.

Student Learning Outcomes (SLO):	5, 9, 10, 12 and 16

Module:1	**Lessons on excellence**	**2hours**

Skill introspection, Skill acquisition, consistent practice

Module:2	**Logical Reasoning**	**18 hours**

Thinking Skill

- Problem Solving
- Critical Thinking
- Lateral Thinking

Taught through thought-provoking word and rebus puzzles, and word-link builder questions

Coding & decoding, Series, Analogy, Odd man out and Visual reasoning

- Coding and Decoding
- Series
- Analogy
- Odd Man Out
- Visual Reasoning

Sudoku puzzles

Solving introductory to moderate level sudoku puzzles to boost logical thinking and comfort with numbers

Attention to detail

Picture and word driven Qs to develop attention to detail as a skill

Module:3	**Quantitative Aptitude**	**14 hours**

Speed Maths

- Addition and Subtraction of bigger numbers
- Square and square roots
- Cubes and cube roots
- Vedic maths techniques
- Multiplication Shortcuts
- Multiplication of 3 and higher digit numbers
- Simplifications
- Comparing fractions
- Shortcuts to find HCF and LCM
- Divisibility tests shortcuts

Algebra and functions

Module:4	**Recruitment Essentials**	**5hours**

Looking at an engineering career through the prism of an effective resume

- Importance of a resume - the footprint of a person's career achievements
- How a resume looks like?
- An effective resume vs. a poor resume: what skills you must build starting today and how?

Impression Management

Getting it right for the interview:

- Grooming, dressing
- Body Language and other non-verbal signs
- Displaying the right behaviour

Module:5	**Verbal Ability**	**6hours**

Grammar challenge

A practice paper with sentence based and passage-based questions on grammar discussed. Topics covered in questions are Nouns and Pronouns, Verbs, Subject-Verb Agreement, Pronoun-Antecedent Agreement, Punctuations

Verbal reasoning

	Total Lecture hours:	**45 hours**

Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

Text Book(s):

1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.
2. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd.
3. **SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press.**
4. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition,

S. Chand Publishing, Delhi.
Reference Book(s): Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.

Course Code	Course Title	L	T	P	J	C
STS 1202	Introduction to quantitative, logical and verbal ability	3	0	0	0	1

Pre-requisite	None	Syllabus version
		1

Course Objectives:

1. To enhance the logical reasoning skills of the students and improve the problem-solving abilities
2. strengthen the ability to solve quantitative aptitude problems
3. To enrich the verbal ability of the students for academic purpose

Expected Course Outcome:

1. Students will be able to show more confidence in solving problems of Quantitative Aptitude
2. Students will be able to show more confidence in solving problems of Logical Reasoning
3. Students will be able to show more confidence in understanding the questions of Verbal Ability

Student Learning Outcomes (SLO):	5, 9 and 16

Module:1	Logical Reasoning	12 hours

Word group categorization questions

Puzzle type class involving students grouping words into right group orders of logical sense

Cryptarithmetic

Data arrangements and Blood relations

- Linear Arrangement
- Circular Arrangement
- Multi-dimensional Arrangement
- Blood Relations

Module:2	Quantitative Aptitude	20 hours

Ratio and Proportion

- Ratio
- Proportion
- Variation
- Simple equations
- Problems on Ages
- Mixtures and alligations: Problems involving multiple iterations of mixtures

Percentages, Simple and Compound Interest

- Percentages as Fractions and Decimals

- Percentage Increase / Decrease
- Simple Interest
- Compound Interest
- Relation Between Simple and Compound Interest

Number System

- Number system
- Power cycle
- Remainder cycle
- Factors, Multiples
- HCF and LCM

Module:3	**Verbal Ability**	**13 hours**

Reading Comprehension – Advanced

Grammar - application and discussion

A practice paper with sentence based and passage-based questions on grammar discussed. Topics covered in questions are Prepositions, Adjectives and Adverbs, Tenses, Forms and Speech and Voice, Idioms and Phrasal Verbs, Collocations, Gerund and Infinitives

Articles, Prepositions and Interrogatives

- Definite and Indefinite Articles
- Omission of Articles
- Prepositions
- Compound Prepositions and Prepositional Phrases
- Interrogatives

Vocabulary – Advanced

Exposure to challenging placement questions on vocabulary

	Total Lecture hours:	**45 hours**

Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

Text Book(s):

4. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.
5. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd.
6. SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press.
7. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.

Reference Book(s):

Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.

Course code	Course title	L	T	P	J	C
STS2001	Reasoning Skill Enhancement	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2				

Course Objectives:

- To strengthen the social network by the effective use of social media and social interactions.
- To identify own true potential and build a very good personal branding
- To enhance the Analytical and reasoning skills.

Expected Course Outcome:

- Understanding the various strategies of conflict resolution among peers and supervisors and respond appropriately

Student Learning Outcomes (SLO):	9,12

9. Having problem solving ability- solving social issues and engineering problems [SLO 9]
12. Having adaptive thinking and adaptability [SLO 12]

Module:1	Social Interaction and Social Media	6 hours

Effective use of social media

Types of social media, Moderating personal information, Social media for job/profession, Communicating diplomatically

Networking on social media

Maximizing network with social media, How to advertise on social media

Event management

Event management methods, Effective techniques for better event management

Influencing

How to win friends and influence people, Building relationships, Persistence and resilience,

Tools for talking when stakes are high

Conflict resolution

Definition and strategies ,Styles of conflict resolution

Module:2	**Non Verbal Communication**	**6 hours**

Proximecs
Types of proximecs**,** Rapport building
Reports and Data Transcoding
Types of reports
Negotiation Skill
Effective negotiation strategies
Conflict Resolution
Types of conflicts

Module:3	**Interpersonal Skill**	**8 hours**

Social Interaction

Interpersonal Communication,Peer Communication, Bonding,Types of social interaction

Responsibility

Types of responsibilities**,** Moral and personal responsibilities

Networking

Competition, Collaboration, Content sharing

Personal Branding

Image Building, Grooming, Using social media for branding

Delegation and compliance

Assignment and responsibility, Grant of authority, Creation of accountability

Module:4	**Quantitative Ability**	**10 hours**

Number properties

Number of factors, Factorials, Remainder Theorem, Unit digit position, Tens digit position

Averages

Averages, Weighted Average

Progressions

Arithmetic Progression, Geometric Progression, Harmonic Progression

Percentages Increase & Decrease or successive increase **Ratios** Types of ratios and proportions			
Module:5	**Reasoning Ability**		**8 hours**
Analytical Reasoning Data Arrangement(Linear and circular & Cross Variable Relationship), Blood Relations, Ordering/ranking/grouping, Puzzletest, Selection Decision table			
Module:6	**Verbal Ability**		**7 hours**
Vocabulary Building Synonyms & Antonyms, One word substitutes, Word Pairs, Spellings, Idioms, Sentence completion, Analogies			
	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	FACE, Aptipedia Aptitude Encyclopedia, 2016, First Edition, Wiley Publications, Delhi.
2.	ETHNUS, Aptimithra, 2013, First Edition, McGraw-Hill Education Pvt.Ltd.
3.	Mark G. Frank, David Matsumoto, Hyi Sung Hwang, Nonverbal Communication: Science and Applications, 2012, 1st Edition, Sage Publications, New York.
Reference Books	
1.	Arun Sharma, Quantitative aptitude, 2016, 7th edition, Mcgraw Hill Education Pvt. Ltd.
2.	Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler, Crucial Conversations: Tools for Talking When Stakes are High, 2001,1st edition McGraw Hill Contemporary, Bangalore.
3.	Dale Carnegie, How to Win Friends and Influence People, Latest Edition,2016. Gallery Books, New York.

Mode of evaluation: FAT, Assignments, Projects, Case studies, Role plays, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies	09/06/2017		
Approved by Academic Council	No. 45th AC	Date	15/06/2017

VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Course code	Course title	L	T	P	J	C
STS2002	Introduction to Etiquette	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2				

Course Objectives:

1. To analyze social psychological phenomena in terms of impression management.
2. To control or influence other people's perceptions.
3. To enhance the problem solving skills

Expected Course Outcome:

Creating in the students an understanding of decision making models and generating alternatives using appropriate expressions.

Student Learning Outcomes (SLO):	**13,18**

13. Having cross cultural competency exhibited by working in teams.

18. Having critical thinking and innovative skills.

Module:1	Impression Management	8 hours

Types and techniques

Importance of impression management, Types of impression management, Techniques and case studies, Making a good first impression in an interview (TEDOS technique) , How to recover from a bad impressions/experience, Making a good first impression online

Non-verbal communication and body language

Dressing, Appearance and Grooming, Facial expression and Gestures, Body language (Kinesics), Keywords to be used, Voice elements (tone, pitch and pace)

Module:2	Thinking Skills	4 hours

Introduction to problem solving process
Steps to solve the problem, Simplex process
Introduction to decision making and decision making process
Steps involved from identification to implementation**,** Decision making model

Module:3	**Beyond Structure**		**4 hours**

Art of questioning

How to frame questions, Blooms questioning pyramid, Purpose of questions

Etiquette

Business, Telephone etiquette, Cafeteria etiquette, Elevator etiquette, Email etiquette, Social media etiquette

Module:4	**Quantitative Ability**	**9 hours**

Profit and Loss

Cost Price & Selling Price, Margins & Markup

Interest Calculations

Simple Interest, Compound Interest, Recurring

Mixtures and solutions

Ratio & Averages, Proportions

Time and Work

Pipes & Cisterns, Man Day concept, Division Wages

Time Speed and Distance

Average speed, Relative speed, Boats and streams.

Proportions & Variations

Module:5	**Reasoning Ability**	**11 hours**

Logical Reasoning
Sequence and series, Coding and decoding, Directions
Visual Reasoning
Abstract Reasoning, Input Type Diagrammatic Reasoning, Spatial reasoning, Cubes
Data Analysis And Interpretation
DI-Tables/Charts/Text

Module:6	**Verbal Ability**	**9 hours**

Grammar
Spot the Errors, Sentence Correction, Gap Filling Exercise, Sentence Improvisations, Misc. Grammar Exercise

	Total Lecture hours:	**45 hours**	

Text Book(s)

1.	Micheal Kallet, Think Smarter: Critical Thinking to Improve Problem-Solving and Decision-Making Skills, April 7, 2014, 1st Edition, Wiley, New Jersey.
2.	MK Sehgal, Business Communication, 2008, 1st Edition, Excel Books, India.
3.	FACE, Aptipedia Aptitude Encyclopedia, 2016, First Edition, Wiley Publications, Delhi.
4.	ETHNUS, Aptimithra, 2013, First edition, McGraw-Hill Education Pvt. Ltd, Banglore.

Reference Books

1.	Andrew J. DuBrin, Impression Management in the Workplace: Research, Theory and Practice, 2010, 1st edition, Routledge.
2.	Arun Sharma, Manorama Sharma, Quantitative aptitude, 2016, 7th edition, McGraw Hill Education Pvt. Ltd, Banglore.
3.	M. Neil Browne, Stuart M. Keeley, Asking the right questions, 2014, 11th Edition, Pearson, London.

Mode of Evaluation: FAT, Assignments, Projects, Case studies, Role plays,
3 Assessments with Term End FAT (Computer Based Test)

Recommended by Board of Studies	09/06/2017		
Approved by Academic Council	No. 45th AC	Date	15/06/2017

Course code	Course title	L	T	P	J	C
STS 2101	Getting started to skill enhancement	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. To develop the students' logical thinking skills and apply it in the real-life scenarios
2. To learn the strategies of solving quantitative ability problems
3. To enrich the verbal ability of the students

Expected Course Outcome:

1. Students will be able to demonstrate critical thinking skills, such as problem solving related to their subject matters
2. Students will be able to demonstrate competency in verbal, quantitative and reasoning aptitude
3. Students will be able to perform good written communication skills

Student Learning Outcomes (SLO):	5, 9 and 16

Module:1	Logical Reasoning	11 hours

Clocks, calendars, Direction sense and Cubes

- Clocks
- Calendars
- Direction Sense
- Cubes

Data interpretation and Data sufficiency

- Data Interpretation – Tables
- Data Interpretation - Pie Chart
- Data Interpretation - Bar Graph
- Data Sufficiency

Module:2	Quantitative Aptitude	18 hours

Time and work

- Work with different efficiencies
- Pipes and cisterns
- Work equivalence
- Division of wages

Time, Speed and Distance

- Basics of time, speed and distance
- Relative speed
- Problems based on trains
- Problems based on boats and streams
- Problems based on races

Profit and loss, Partnerships and averages

- Basic terminologies in profit and loss
- Partnership
- Averages
- Weighted average

Module:3	**Verbal Ability**	**13hours**

Sentence Correction

- Subject-Verb Agreement
- Modifiers
- Parallelism
- Pronoun-Antecedent Agreement
- Verb Time Sequences
- Comparisons
- Prepositions
- Determiners

Sentence Completion and Para-jumbles

- Pro-active thinking
- Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues)
- Fixed jumbles
- Anchored jumbles

Module:4	**Writing skills for placements**	**3 hours**

Essay writing

- Idea generation for topics
- Best practices
- Practice and feedback

	Total Lecture hours:	**45 hours**

Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

Text Book(s):

1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.
2. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd.
3. **SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press.**
4. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.

Reference Book(s):

Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.

Course code	Course title	L	T	P	J	C
STS 2102	Enhancing problem solving skills	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. To develop the students' logical thinking skills and apply it in the real-life scenarios
2. To learn the strategies of solving quantitative ability problems
3. To enrich the verbal ability of the students
4. To strengthen the basic programming skills for placements

Expected Course Outcome:

1. The students will be able to interact confidently and use decision making models effectively
2. The students will be able to deliver impactful presentations
3. The students will be able to be proficient in solving quantitative aptitude and verbal ability questions effortlessly

Student Learning Outcomes (SLO):	5, 7, 9, 12 and 16

Module:1	Logical Reasoning	5 hours

Logical connectives, Syllogism and Venn diagrams

- Logical Connectives
- Syllogisms
- Venn Diagrams – Interpretation

Venn Diagrams – Solving

Module:2	Quantitative Aptitude	11 hours

Logarithms, Progressions, Geometry and Quadratic equations

- Logarithm
- Arithmetic Progression
- Geometric Progression
- Geometry
- Mensuration
- Coded inequalities
- Quadratic Equations

Permutation, Combination and Probability

- Fundamental Counting Principle
- Permutation and Combination
- Computation of Permutation
- Circular Permutations
- Computation of Combination

Probability

Module:3	**Verbal Ability**	**4 hours**

Critical Reasoning

- Argument – Identifying the Different Parts (Premise, assumption, conclusion)
- Strengthening statement
- Weakening statement
- Mimic the pattern

Module:4	**Recruitment Essentials**	**7 hours**

Cracking interviews - demonstration through a few mocks

Sample mock interviews to demonstrate how to crack the:

- HR interview
- MR interview
- Technical interview

Cracking other kinds of interviews

- Skype/ Telephonic interviews
- Panel interviews
- Stress interviews

Resume building – workshop

A workshop to make students write an accurate resume

Module:5	**Problem solving and Algorithmic skills**	**18 hours**

- Logical methods to solve problem statements in Programming
- Basic algorithms introduced

	Total Lecture hours:	**45 hours**

Mode of Evaluation: FAT, Assignments, Mock interviews, 3 Assessments with Term End FAT (Computer Based Test)

Text Book(s):

5. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.
6. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd.
7. **SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press.**
8. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.

Reference Book(s):

Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.

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Course code	Course Title	L	T	P	J	C
STS 2201	Numerical ability and cognitive intelligence	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. To develop the students' logical thinking skills and apply it in the real-life scenarios
2. To learn the strategies of solving quantitative ability problems
3. To enrich the verbal ability of the students

Expected Course Outcome:

1. Students will be able to demonstrate critical thinking skills, such as problem solving related to their subject matters
2. Students will be able to demonstrate competency in verbal, quantitative and reasoning aptitude
3. Students will be able to perform good written communication skills

Student Learning Outcomes (SLO):	5, 9 and 16

Module:1	Logical Reasoning	10 hours

Clocks, calendars, Direction sense and Cubes

- Clocks
- Calendars
- Direction Sense
- Cubes

Practice on advanced problems

Data interpretation and Data sufficiency - Advanced

- Advanced Data Interpretation and Data Sufficiency questions of CAT level
- Multiple chart problems
- Caselet problems

Module:2	Quantitative Aptitude	19 hours

Time and work – Advanced

- Work with different efficiencies
- Pipes and cisterns: Multiple pipe problems
- Work equivalence
- Division of wages
- Advanced application problems with complexity in calculating total work

Time, Speed and Distance - Advanced

- Relative speed
- Advanced Problems based on trains
- Advanced Problems based on boats and streams

- Advanced Problems based on races

Profit and loss, Partnerships and averages - Advanced

- Partnership
- Averages
- Weighted average

Advanced problems discussed

Number system - Advanced

Advanced application problems on Numbers involving HCF, LCM, divisibility tests, remainder and power cycles.

Module:3	**Verbal Ability**	**13 hours**

Sentence Correction - Advanced

- Subject-Verb Agreement
- Modifiers
- Parallelism
- Pronoun-Antecedent Agreement
- Verb Time Sequences
- Comparisons
- Prepositions
- Determiners

Quick introduction to 8 types of errors followed by exposure to GMAT level questions

Sentence Completion and Para-jumbles - Advanced

- Pro-active thinking
- Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues)
- Fixed jumbles
- Anchored jumbles

Practice on advanced GRE/ GMAT level questions

Reading Comprehension – Advanced

Exposure to difficult foreign subject-based RCs of the level of GRE/ GMAT

Module:4	**Writing skills for placements**	**3 hours**

Essay writing

- Idea generation for topics
- Best practices
- Practice and feedback

	Total Lecture hours:	**45 hours**

Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

Text Book(s):

4. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.

5. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd.
6. **SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press.**
7. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.

Reference Book(s):

Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.

Course code	Course Title	L	T	P	J	C
STS 2202	Advanced aptitude and reasoning skills	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. To develop the students' logical thinking skills and apply it in the real-life scenarios
2. To learn the strategies of solving quantitative ability problems
3. To enrich the verbal ability of the students
4. To strengthen the basic programming skills for placements

Expected Course Outcome:

1. The students will be able to interact confidently and use decision making models effectively
2. The students will be able to deliver impactful presentations
3. The students will be able to be proficient in solving quantitative aptitude and verbal ability questions effortlessly

Student Learning Outcomes (SLO):	5, 7, 9, 12 and 16

Module:1	Logical Reasoning	4 hours

Logical Reasoning puzzles - Advanced

Advanced puzzles:

1. Sudoku
2. Mind-bender style word statement puzzles
3. Anagrams
4. Rebus puzzles

Logical connectives, Syllogism and Venn diagrams

1. Logical Connectives
2. Advanced Syllogisms - 4, 5, 6 and other multiple statement problems
3. Challenging Venn Diagram questions: Set theory

Module:2	Quantitative Aptitude	10 hours

Logarithms, Progressions, Geometry and Quadratic equations - Advanced

1. Logarithm
2. Arithmetic Progression
3. Geometric Progression
4. Geometry
5. Mensuration
6. Coded inequalities
7. Quadratic Equations

Concepts followed by advanced questions of CAT level

Permutation, Combination and Probability - Advanced

- Fundamental Counting Principle
- Permutation and Combination
- Computation of Permutation - Advanced problems
- Circular Permutations
- Computation of Combination - Advanced problems
- Advanced probability

Module:3	**Verbal Ability**	**5 hours**

Image interpretation

1. Image interpretation: Methods
2. Exposure to image interpretation questions through brainstorming and practice

Critical Reasoning - Advanced

1. Concepts of Critical Reasoning
2. Exposure to advanced questions of GMAT level

Module:4	**Recruitment Essentials**	**8 hours**

Mock interviews

Cracking other kinds of interviews

Skype/ Telephonic interviews
Panel interviews
Stress interviews

Guesstimation

1. Best methods to approach guesstimation questions
2. Practice with impromptu interview on guesstimation questions

Case studies/ situational interview

1. Scientific strategies to answer case study and situational interview questions
2. Best ways to present cases
3. Practice on presenting cases and answering situational interviews asked in recruitment rounds

Module:5	**Problem solving and Algorithmic skills**	**18 hours**

1. Logical methods to solve problem statements in Programming
2. Basic algorithms introduced

	Total Lecture hours:	**45 hours**

Mode of Evaluation: FAT, Assignments, Mock interviews, 3 Assessments with Term End FAT (Computer Based Test)

Text Book(s):

8. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.

9. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd.
10. SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press.
11. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.

Reference Book(s):

Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.

Course code	Course title	L	T	P	J	C
STS3001	Preparedness for external opportunities	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2				

Course Objectives:

1. To effectively tackle the interview process, and leave a positive impression with your prospective employer by reinforcing your strength, experience and appropriateness for the job.
2. To check if candidates have the adequate writing skills that are needed in an organization.
3. To enhance the problem solving skills.

Expected Course Outcome:

- Enabling students acquire skills for preparing for interviews, presentations and higher education

Student Learning Outcomes (SLO): **9, 18**

9. Having problem solving ability- solving social issues and engineering problems

18. Having critical thinking and innovative skills

Module:1	Interview Skills	3 hours

Types of interview

Structured and unstructured interview orientation, Closed questions and hypothetical questions, Interviewers' perspective, Questions to ask/not ask during an interview

Techniques to face remote interviews

Video interview, Recorded feedback , Phone interview preparation

Mock Interview

Tips to customize preparation for personal interview, Practice rounds

Module:2	Resume Skills	2 hours

Resume Template

Structure of a standard resume**,** Content, color, font

Use of power verbs

Introduction to Power verbs and Write up

Types of resume

Quiz on types of resume

Customizing resume

Frequent mistakes in customizing resume, Layout - Understanding different company's requirement, Digitizing career portfolio

Module:3	Presentation Skills	6 hours

Preparing presentation

10 tips to prepare PowerPoint presentation**,** Outlining the content, Passing the Elevator Test

Organizing materials

Blue sky thinking, Introduction , body and conclusion, Use of Font, Use of Color, Strategic presentation

Maintaining and preparing visual aids

Importance and types of visual aids, Animation to captivate your audience, Design of posters

Dealing with questions

Setting out the ground rules, Dealing with interruptions, Staying in control of the questions, Handling difficult questions

Module:4	Quantative Ability	14 hours

Permutation-Combinations

Counting, Grouping, Linear Arrangement, Circular Arrangements

Probability

Conditional Probability, Independent and Dependent Events

Geometry and Mensuration

Properties of Polygon, 2D & 3D Figures, Area & Volumes

Trigonometry

Heights and distances, Simple trigonometric functions

Logarithms

Introduction, Basic rules

Functions

Introduction, Basic rules

Quadratic Equations

Understanding Quadratic Equations, Rules & probabilities of Quadratic Equations

Set Theory

Basic concepts of Venn Diagram

Module:5	**Reasoning Ability**	**7 hours**

Logical reasoning
Syllogisms, Binary logic, Sequential output tracing, Crypto arithmetic
Data Analysis and Interpretation
Data Sufficiency
Data interpretation-Advanced Interpretation tables, pie charts & bar chats

Module:6	**Verbal Ability**	**8 hours**

Comprehension and Logic
Reading comprehension
Para Jumbles
Critical Reasoning :
Premise and Conclusion, Assumption & Inference, Strengthening & Weakening an Argument

Module:7	**Writing Skills**	**5 hours**

Note making
What is note making, Different ways of note making
Report writing
What is report writing, How to write a report, Writing a report & work sheet
Product description
Designing a product, Understanding it's features, Writing a product description
Research paper
Research and its importance, Writing sample research paper

	Total Lecture hours:	**45 hours**	

Text Book(s)

1.	Michael Farra, Quick Resume & Cover letter Book, 2011, 1st Edition, JIST Editors, Saint Paul.
2.	Daniel Flage, An Introduction to Critical Thinking, 2002, 1st Edition, Pearson, London.

Reference Books

1.	FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.
2.	ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt. Ltd.

Mode of Evaluation: FAT, Assignments, Projects, Case studies, Role plays,
3 Assessments with Term End FAT (Computer Based Test)

Recommended by Board of Studies	09/06/2017		
Approved by Academic Council	No. 45th AC	Date	15/06/2017

Course code	Course title	L	T	P	J	C
STS3004	Data Structures and Algorithms	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2				

Course Objectives:

1. To assess how the choice of data structures and algorithm design methods impacts the performance of programs.
2. To develop logics which will help them to create programs, applications in C.
3. To learn how to design a graphical user interface (GUI) with Java Swing.

Expected Course Outcome:

- Clear knowledge about problem solving skills in DS & Algorithms concepts

Student Learning Outcomes (SLO): 7, 17

7. Having computational thinking (Ability to translate vast data in to abstract concepts and to understand database reasoning)
17. Having an ability to use techniques, skills and modern engineering tools necessary for engineering practice

Module:1	**Data Structures**	**10 hours**

Introduction to data structures, Array, Linked List, Stack, Queue, Trees.

Module:2	**Algorithms**	**15 hours**

Introduction to Algorithms, Searching Algorithms, Sorting Algorithms, Greedy Algorithm, Divide and Conquer, Analysis of Algorithm.

Module:3	**C Programming**	**10 hours**

Introduction to C, Execution and Structure of a C Program, Data Types and Operators, Control Statements, Looping, Arrays, Structure, Pointers, Memory Management in C, Functions

Module:4	**C++ Programming**	**5 hours**

Introduction to C++, Need for OOP, Class & Objects, Create C++ & Java class and show the similarity Encapsulation, Access Specifiers, Relationship, Polymorphism, Exception Handling, Abstract Classes.

Module:5	**JAVA**	**5 hours**

Introduction to Java, Data Types and Operators, Control Statements, Looping, Arrays, Need for OOP, Class & Objects, Create C++ & Java class and show the similarity Encapsulation, Access Specifiers, Relationship, Polymorphism, Exception Handling, Abstract Classes, Interfaces.

	Total Lecture hours:	**45 hours**	

Reference Books

1. Data Structures and Algorithms: https://ece.uwaterloo.ca/~dwharder/aads/Lecture_materials/: University of waterloo
2. C Programming: C Programming Absolute Beginner's Guide (3rd Edition) by Greg Perry, Dean Miller
3. Java: Thinking in Java, 4th Edition

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Mode of Evaluation: FAT, Assignments, Projects, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies	09/06/2017		
Approved by Academic Council	No. 45th AC	Date	15/06/2017

Course code	Course title	L	T	P	J	C
STS3007	Preparedness for Recruitment	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2				

Course Objectives:

- To enrich the logical thinking ability for better analysis and decision making
- To hone the competence in solving problems and reasoning skills
- To build a good vocabulary and use it in effective communication

Expected Course Outcome:

- Students will be able to solve mathematical, reasoning and verbal questionnaires

Student Learning Outcomes (SLO):	2, 17

2. Having a clear understanding of the subject related concepts and of contemporary issues

17. Having an ability to use techniques, skills and modern engineering tools necessary for engineering practice

Module:1	Quantitative Ability	15 hours

Time and Work, Time Speed and Distance, Number System, Equations, Percentages, Profit and Loss, Permutation and Combination, Probability, Geometry and Mensuration, Averages, Progression, Allegations and Mixtures, Ages

Module:2	Reasoning Ability	12 hours

Data Arrangement - Linear, Circular and Cross Variable Relationship**,** Data Sufficiency, Data Interpretation-Advanced Interpretation Tables**,** Coding and Decoding, Abstract Reasoning, Input Type Diagrammatic Reasoning, Spatial Reasoning, Cubes, Clocks and Calendar

Module:3	Verbal Ability	18 hours

Vocabulary Building
Synonyms & Antonyms, One word substitutes, Word Pairs, Spellings, Idioms, Sentence completion, Analogies, Cloze Test.
Comprehension and Logic
Reading comprehension
Para Jumbles
Critical Reasoning :
Premise and Conclusion, Assumption & Inference, Strengthening & Weakening an Argument.
Sentence Correction
Modifiers, parallelism, Verb time sequences, Comparison, Determiners.
Building personal lexicon

Benefits of becoming a logophile, Etymology – Root words, Prefix and suffix.			
Text Book(s)			
1.	FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.		
2.	ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd.		
3.	R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.		
Reference Books			
1.	Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.		
Mode of evaluation: Assignments, Projects, Case studies, FAT (Computer Based Test)			
Recommended by Board of Studies	09/06/2017		
Approved by Academic Council	No.45th	Date	15/06/2017

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Course code	Course title	L	T	P	J	C
STS 3101	Introduction to programming skills	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. Ability to translate vast data into abstract concepts and to understand JAVA concepts
2. To have a clear understanding of subject related concepts
3. To develop computational ability in Java programming language

Expected Course Outcome:

1. Clear Knowledge about problem solving skills in JAVA concepts
2. Students will be able to write codes in Java

Student Learning Outcomes (SLO):	7 & 18

Module:1	Object and Class, Data types	8 hours

Types of programming
Disadvantages of functional programming
Class & Objects
Attributes
Methods
Objects
Solving MCQs based on Objects and Classes
Solving tricky questions based on encapsulation
Solving frequently asked object-based questions
Data types
Data
Why data type
Variables
Available data types
Numeric – int, float, double
Character – char, string
Solving MCQs based on type casting, data types
Solving debugging based MCQs

Module:2	Basic I / O, Decision Making, Loop Control	8 hours

Printing
Getting input from user during run time
Command line arguments
Solving programming questions based on CLA
Solving MCQs questions based on CLA

Need for control statement
if..else

if..else if..else Nested if..else Switch case Common mistakes with control statements (like using = instead of ==) Solving frequently asked questions on decision making Types of looping statements Entry Controlled For While Exit Controlled do while break and continue Demo on looping Common mistakes with looping statements (like using; at the end of the loop) Solving pattern programming problems, series problems Solving predict the output questions		
Module:3	**String, Date, Array**	**10 hours**
String handling, date handling Solving problems based on arrays like searching, sorting, rearranging, iteration) Multi-dimensional arrays Solving pattern problems using 2D arrays Real time application based on 2D arrays		
Module:4	**Inheritance, Aggregation & Associations**	**12 hours**
Need Is A – Inheritance Types of inheritance supported Diagrammatic representation Demo on inheritance Has A – Aggregation Diagrammatic representation Demo on aggregation Uses A - Association Diagrammatic representation Demo on association Assignment on relationships Solving MCQs based on relationships between classes		
Module:5	**Modifiers, Interface & Abstract classes (Java specific), Packages**	**7 hours**
Types of access specifiers Demo on access specifiers Assignment on access modifiers Instance Members Solving MCQs based on modifiers Abstract Classes		

Need Abstract Classes Abstract Methods Interfaces Assignment on abstract classes and interface Need for packages Access specifiers & packages Import classes from other packages		
	Total Lecture hours:	**45 hours**
Reference Books		
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd	
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean	
Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)		

Course code	Course title	L	T	P	J	C
STS 3105	Computational thinking	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. Ability to translate vast data into abstract concepts and to understand JAVA concepts
2. To have a clear understanding of subject related concepts
3. To develop computational ability in Java programming language

Expected Course Outcome:

1. Clear Knowledge about problem solving skills in JAVA concepts
2. Students will be able to write codes in Java

Student Learning Outcomes (SLO):	7 & 18

Module:1	Date, Array	10 hours

date handling
Solving problems based on arrays like searching, sorting, rearranging, iteration)
Multi-dimensional arrays
Solving pattern problems using 2D arrays
Real time application based on 2D arrays

Module:2	Inheritance, Aggregation & Associations	15 hours

Need
Is A – Inheritance
Types of inheritance supported
Diagrammatic representation
Demo on inheritance
Has A – Aggregation
Diagrammatic representation
Demo on aggregation
Uses A - Association
Diagrammatic representation
Demo on association
Assignment on relationships
Solving MCQs based on relationships between classes

Module:3	Modifiers, Interface & Abstract classes (Java specific)	10 hours

Types of access specifiers
Demo on access specifiers
Assignment on access modifiers
Instance Members
Solving MCQs based on modifiers

Abstract Classes

Need Abstract Classes Abstract Methods Interfaces Assignment on abstract classes and interface		
Module:4	**Packages**	**5 hours**
Need for packages Access specifiers & packages Import classes from other packages		
Module:5	**Exceptions**	**5 hours**
Need for exception handling try, catch, throw, throws Creating own exception (Java, Python) Handling own exceptions		
	Total Lecture hours:	**45 hours**

Reference Books	
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean

Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

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Course code	Course title	L	T	P	J	C
STS 3201	Programming skills for employment	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. Ability to translate vast data into abstract concepts and to understand JAVA concepts
2. To have a clear understanding of subject related concepts
3. To develop computational ability in Java programming language

Expected Course Outcome:

1. Clear Knowledge about problem solving skills in JAVA concepts
2. Students will be able to write codes in Java

Student Learning Outcomes (SLO):	7 & 18

Module:1	Object and Class, Data types, Basic I / O	8 hours

Types of programming
Disadvantages of functional programming
Class & Objects
Attributes
Methods
Objects
Solving MCQs based on Objects and Classes
Solving tricky questions based on encapsulation
Solving frequently asked object based questions

Data types
Data
Why data type
Variables
Available data types
Numeric – int, float, double
Character – char, string
Solving MCQs based on type casting, data types
Solving debugging based MCQs

Printing
Getting input from user during run time
Command line arguments
Solving programming questions based on CLA
Solving MCQs questions based on CLA

Module:2	**Decision Making, Loop Control, String, Date, Array**	**10 hours**

Need for control statement
if..else
if..else if..else
Nested if..else
Switch case
Common mistakes with control statements (like using = instead of ==)
Solving frequently asked questions on decision making

Types of looping statements
Entry Controlled
For
While
Exit Controlled
do while
break and continue
Demo on looping
Common mistakes with looping statements (like using ; at the end of the loop)
Solving pattern programming problems, series problems
Solving predict the output questions

String handling, date handling
Solving problems based on arrays like searching, sorting, rearranging, iteration)
Multi-dimensional arrays
Solving pattern problems using 2D arrays
Real time application based on 2D arrays

Module:3	**Inheritance, Aggregation & Associations**	**10 hours**

Need
Is A – Inheritance
Types of inheritance supported
Diagrammatic representation
Demo on inheritance
Has A – Aggregation
Diagrammatic representation
Demo on aggregation
Uses A - Association
Diagrammatic representation
Demo on association
Assignment on relationships
Solving MCQs based on relationships between classes

Module:4	**Modifiers, Interface & Abstract classes (Java specific), Packages**	**7 hours**

Types of access specifiers

Demo on access specifiers Assignment on access modifiers Instance Members Solving MCQs based on modifiers Abstract Classes Need Abstract Classes Abstract Methods Interfaces Assignment on abstract classes and interface Need for packages Access specifiers & packages Import classes from other packages		
Module:5	**Collections**	**10 hours**
ArrayList, LinkedList, List Interface, HashSet, Map Interface, HashMap, Set Programming questions based on collections Real world problems based on data structure		
	Total Lecture hours:	**45 hours**

Reference Books	
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean

Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

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Course code	Course title	L	T	P	J	C
STS3204	JAVA programming and software engineering fundaments	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. Ability to translate vast data into abstract concepts and to understand JAVA concepts
2. To have a clear understanding of subject related concepts
3. To develop computational ability in Java programming language

Expected Course Outcome:

1. Clear Knowledge about problem solving skills in JAVA concepts
2. Students will be able to write codes in Java

Student Learning Outcomes (SLO):	7 & 18

Module:1	Threads, Exceptions, LinkedList, Arrays, Stack and Queue	8 hours

Need of threads
Creating threads
Wait
Sleep
Thread execution
Need for exception handling
try, catch, throw, throws
Creating own exception (Java, Python)
Handling own exceptions
Solving programming questions based on linked list and arrays
Solving programming questions based on stacks and queues
How to implement a stack using queue?
How to implement a queue using stack?

Module:2	Trees, JDBC Connectivity	7 hours

Solving programming questions based on trees, binary trees, binary search trees
JDBC Overview
Database Setup
Install the MySQL Database
Create New Database User in MySQL Workbench

Module:3	JDBC Data	6 hours

Selecting data from tables
Inserting Data into the Database
Updating Data in the Database
Deleting Data from the Database

Creating Prepared Statements		
Module:4	**Networking with Java**	**12 hours**
Working with URLs Sending HTTP Requests Processing JSON data using Java Processing XML data using Java		
Module:5	**Advanced programming**	**12 hours**
File Operations CSV Operations Encoder & Decoders Encryption & Decryption Hashes Loggers		
	Total Lecture hours:	**45 hours**

Reference Books	
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean

Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

Course code	Course title	L	T	P	J	C
STS 3205	Advanced JAVA Programming	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. Ability to translate vast data into abstract concepts and to understand JAVA concepts
2. To have a clear understanding of subject related concepts
3. To develop computational ability in Java programming language

Expected Course Outcome:

1. Clear Knowledge about problem solving skills in JAVA concepts
2. Students will be able to write codes in Java

Student Learning Outcomes (SLO):	7 & 18

Module:1	Associations, Modifiers	9 hours

Uses A - Association
Diagrammatic representation
Demo on association
Assignment on relationships
Solving MCQs based on relationships between classes

Types of access specifiers
Demo on access specifiers
Assignment on access modifiers
Instance Members
Solving MCQs based on modifiers

Module:2	Interface & Abstract classes (Java specific), Packages	10 hours

Abstract Classes
Need
Abstract Classes
Abstract Methods
Interfaces
Assignment on abstract classes and interface

Need for packages
Access specifiers & packages
Import classes from other packages

Module:3	Exceptions	7 hours

Need for exception handling
try, catch, throw, throws

Creating own exception (Java, Python) Handling own exceptions		
Module:4	**Collections**	**15 hours**
ArrayList, LinkedList, List Interface, HashSet, Map Interface, HashMap, Set Programming questions based on collections Real world problems based on data structure		
Module:5	**LinkedList, Arrays**	**4 hours**
Solving programming questions based on linked list and arrays		
	Total Lecture hours:	**45 hours**
Reference Books		
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd	
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean	
Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)		

Course code	Course title	L	T	P	J	C
STS 3301	JAVA for beginners	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

1. Ability to translate vast data into abstract concepts and to understand JAVA concepts
2. To have a clear understanding of subject related concepts
3. To develop computational ability in Java programming language

Expected Course Outcome:

1. Clear Knowledge about problem solving skills in JAVA concepts
2. Students will be able to write codes in Java

Student Learning Outcomes (SLO):	7 & 18

Module:1	Introduction to Programming	10 hours

Introduction to Flow Charts
Pseudo code
Program Development Steps & Algorithms
Computer Operations & Data Types
Comparison Operators
Single Selection
Dual Selection
Three or More Choices
Nested Ifs
Boolean Operators
Loops

Module:2	Object and Class	10 hours

Types of programming
Disadvantages of functional programming
Class & Objects
Attributes
Methods
Objects
Solving MCQs based on Objects and Classes
Solving tricky questions based on encapsulation
Solving frequently asked object based questions

Module:3	Data types, Basic I / O	10 hours

Data types
Data
Why data type
Variables
Available data types

Numeric – int, float, double Character – char, string Solving MCQs based on type casting, data types Solving debugging based MCQs Printing Getting input from user during run time Command line arguments Solving programming questions based on CLA Solving MCQs questions based on CLA		
Module:4	**Decision Making, Loop Control**	**10 hours**
Need for control statement if..else if..else if..else Nested if..else Switch case Common mistakes with control statements (like using = instead of ==) Solving frequently asked questions on decision making Types of looping statements Entry Controlled For While Exit Controlled do while break and continue Demo on looping Common mistakes with looping statements (like using ; at the end of the loop) Solving pattern programming problems, series problems Solving predict the output questions		
Module:5	**String**	**5 hours**
String handling		
	Total Lecture hours:	**45 hours**

Reference Books	
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean

Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

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Course code	Course title	L	T	P	J	C
STS 3401	Foundation to programming skills	3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1				

Course Objectives:

4. Ability to translate vast data into abstract concepts and to understand JAVA concepts
5. To have a clear understanding of subject related concepts
6. To develop computational ability in Java programming language

Expected Course Outcome:

3. Clear Knowledge about problem solving skills in JAVA concepts
4. Students will be able to write codes in Java

Student Learning Outcomes (SLO):	7 & 18

Module:1	Object and Class	8 hours

Types of programming
Disadvantages of functional programming
Class & Objects
Attributes
Methods
Objects
Solving MCQs based on Objects and Classes
Solving tricky questions based on encapsulation
Solving frequently asked object based questions

Module:2	Data types, Basic I / O	8 hours

Data types
Data
Why data type
Variables
Available data types
Numeric – int, float, double
Character – char, string
Solving MCQs based on type casting, data types
Solving debugging based MCQs

Printing
Getting input from user during run time
Command line arguments
Solving programming questions based on CLA
Solving MCQs questions based on CLA

Module:3	Decision Making, Loop Control	9 hours

Need for control statement

if..else if..else if..else Nested if..else Switch case Common mistakes with control statements (like using = instead of ==) Solving frequently asked questions on decision making Types of looping statements Entry Controlled For While Exit Controlled do while break and continue Demo on looping Common mistakes with looping statements (like using ; at the end of the loop) Solving pattern programming problems, series problems Solving predict the output questions		
Module:4	**String, Date, Array**	**10 hours**
String handling, date handling Solving problems based on arrays like searching, sorting, rearranging, iteration) Multi-dimensional arrays Solving pattern problems using 2D arrays Real time application based on 2D arrays		
Module:5	**Inheritance, Aggregation**	**10 hours**
Need Is A – Inheritance Types of inheritance supported Diagrammatic representation Demo on inheritance Has A – Aggregation Diagrammatic representation Demo on aggregation Solving MCQs based on relationships between classes		
	Total Lecture hours:	**45 hours**

Reference Books	
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean

Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

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Programme Core

Course code	Course Title	L	T	P	J	C
BIT 1005	Biochemistry	3	0	2	0	4
Pre-requisite	NIL	Syllabus version				
		2.10				

Course Objectives:

1. Develop the knowledge on the fundamental chemical principles that govern biological systems
2. Distinguish biomolecules and their metabolic pathways
3. Discover the comprehension on the regulation of biological/biochemical processes

Expected Course Outcome:

1. Relate structure and function of biological molecules
2. Solve numerical related to practical work
3. Determine experiments and techniques in relationship to biomolecules
4. Design and propose experimental approaches to solve biochemical questions
5. Apply the knowledge to various field of biotechnology
6. Discuss research opportunities in biochemistry

Student Learning Outcomes (SLO): 1,2,11

Module:1	**Foundations of Biochemistry:**	**5 hours**

Properties of living system - review on cellular, chemical, physical, genetic and evolutionary backgrounds to biochemistry.

Module:2	**Water and buffers:**	**5 hours**

Properties of water- solubility, ionization property and water as a reactant, pH and buffers and their importance.

Module:3	**Carbohydrates:**	**5 hours**

Classification, structure and function. Glycoconjugates: Proteoglycans, glycoproteins and glycolipids.

Module:4	**Metabolism of carbohydrates:**	**5 hours**

Glycolysis, TCA cycle, oxidative phosphorylation, gluconeogenesis and pentose phosphate pathway and their regulation

Module:5	**Amino Acids and proteins**	**9 hours**

Classification, structure and biological importance of amino acids, acid–base chemistry and stereochemistry of amino acids. Amino acid synthesis – precursors and routes of non-essential amino acid relationships with reference to fibrous proteins such as keratin, collagen, silk fibroin and globular proteins such as haemoglobin and myoglobin.

Module:6	**Fatty acids and lipids**	**9 hours**

Classification, structure, properties, function and metabolism of fatty acids. Classification, structure, properties and biological function of simple lipids – triacylglycerol and waxes.

Compound lipids- phospholipids and glycolipids. Cholesterol- structure, properties and importance. Eicosanoids. Formation of mevalonate from acetyl CoA. Terpenes			
Module:7	**Nucleic acids:**		**5 hours**
Composition, properties and function. Metabolism- synthesis of purines and pyrimidine.			
Module:8	**Contemporary issues:**		**2 hours**
Lecture by Industrial Expert			
	Total Lecture hours:	**45 hours**	

Text Book(s)

1.	David L. Nelson and Michael M. Cox. 2017. Lehninger Principles of Biochemistry: International Edition. 7th edition, W.H. Freeman. USA.
2.	Victor W. Rodwell, David A. Bender,Kathleen M. Botham, Peter J. Kennelly and P. Anthony Weil, 2015. Harpers Illustrated Biochemistry. 30th Edition, McGraw-Hill companies, Inc. USA.

Reference Books

1.	Christopher K. Mathews Kensal E. van Holde , Dean R. Appling , Spencer J. Anthony-Cahill . 2012. Biochemistry, 4th Edition. Prentice Hall, United states.
2.	Donald Voet and Judith G. Voet , 2010. Biochemistry. 4th edition. Wiley. North America.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Challenging Experiments (Indicative)

1.	Laboratory practices in biochemistry and reagent preparation (calculations)	3 hours
2.	Quantitative estimation of proteins	4 hours
3.	Quantitative estimation of reducing sugar	3 hours
4.	Quantitative estimation of amino acids	3 hours
5.	Estimation of total sugars	3 hours
6.	Estimation of nucleic acids	
7.	Preparation of buffers	3 hours
8.	pKa estimation	4 hours
9.	Acid- Base titration of amino acids	4 hours
	Total Laboratory Hours	**30 hours**
Mode of evaluation:		

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No.46	23-08-2017	

Course code	Course Title	L	T	P	J	C
BIT 1006	Cell Biology and Genetics	3	0	2	0	4
Pre-requisite	NIL	Syllabus version				
		2.10				

Course Objectives:

1. Develop knowledge on the structure and function of prokaryotic and eukaryotic cells
2. Illustrate the different levels of biological organization, from molecules to cells and organisms.
3. Demonstrate advanced, contemporary and relevant knowledge in Biochemistry, Microbiology, Molecular Biology and Genetics

Expected Course Outcome:

1. Summarize the features of prokaryote and eukaryote cells, the composition and spatial organization of the cell.
2. Compare different principles of how extracellular signals can reach the cell interior, be amplified, transmitted and terminated, and exemplify how signal routes are integrated and how specificity can be achieved.
3. Develop the ways in which molecular biology throws light on gene function and the genetic regulation of cell specialization.
4. Identify the molecular mechanisms behind DNA damage and repair.
5. Assess the molecular mechanisms regulating and controlling cell division and the cell cycle and exemplify how extracellular signals affect cell division.
6. Demonstrate proficiency in quantitative reasoning and analytical skills.

Student Learning Outcomes (SLO):	2,4,8

Module:1	Cell structure and function:	6 hours

Prokaryotic and eukaryotic cell, biomembrane, cell organelles, cytoskeleton structure and functions. Cell adhesion in animal and plant cells

Module:2	Transport across cell membranes:	6 hours

Passive diffusion, uniporters, non-gated and gated ion channels, symporters, antiporters, and ATP pumps.

Module:3	Cell signaling:	7 hours

Autocrine, paracrine and endocrine signaling molecules, secondary signaling molecules, G-protein coupled signal transduction pathway involving cAMP, cGMP, IP_3, DAG and Ca^{2+} as second

messengers			
Module:4	**Cell cycle and regulation:**		**5 hours**
Mitosis and meiosis. Cell cycle control system, regulation of check points by mitogens, cyclins and cdks			
Module:5	**Principles of inheritance**		**6 hours**
Mendelian laws, co-dominance, incomplete dominance, multiple alleles and gene interactions; quantitative and extra chromosomal inheritance.			
Module:6	**Heritable Variations:**		**5 hours**
Linkage, crossing over, sex linked inheritance and chromosomal mapping. Gene and chromosomal mutations.			
Module:7	**Population genetics and human genetics**		**8 hours**
Speciation, derivation of Hardy and Weinberg's equilibrium, Factors affecting the equilibrium and Inbreeding. Euphenics, eugenics and euthenics. Pedigree structure, autosomal, allosomal, mitochondrial and multifactorial inheritance and diseases. Genetic counseling and prenatal diagnosis. Role of genes in cancer. Epigenetics and genomic imprinting.			
Module:8	**Contemporary issues:**	**2 hours**	
Lecture by Industrial Expert			
	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	Arnold Berk , Chris A. Kaiser , Harvey Lodish , Angelika Amon, HiddePloegh, Anthony Bretscher, Monty Krieger, Kelsey C. Martin. 2016. Molecular Cell Biology, 8th edition, W.H. Freeman. USA
2.	Anthony J.F. Griffiths, Susan R. Wessler, Sean B. Carroll and John Doebley. 2010.Introduction to Genetic Analysis. 10th edition. W.H. Freeman. USA
Reference Books	
1.	books published after 2010 (preferably after 2015) to be given (please give complete bibliography)
	Authors, book title, year of publication, edition number, press, place
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

List of Challenging Experiments (Indicative)		
1.	Principles and handling of microscopes; studying the diversity of cells using permanent slides.	4 hours
2.	Differentiating plant cells from animal cells using a basic, acidic and a combination stain.	2 hours
3.	Comparing human squamous male epithelial cells from female cells by	4 hours

	locating Barr bodies	
4.	Subjecting cells to different pH and analyzing the structural changes occurring due to osmosis.	2 hours
5.	Enumerating and finding out whether RBCs/WBCs are in the optimal range in the sample and analyzing the results.	2 hours
6.	Growing root tips of different plants and comparing the chromosome number by fixing at metaphase stage.	2 hours
7.	Comparison of various stages in Meiosis I and Meiosis II during microsporogenesis of *Rheo discolor*.	2 hours
8.	Identifying structural differences between a normal chromosome and a polytene chromosome.	2 hours
9.	Tracing the family pedigree tree for a Mendelian trait; identification of inheritance pattern based on offspring data; testing discrete ratios by chi-square test.	4 hours
10	Calculating recombination frequencies between traits and construction of chromosomal maps; finding out the gene and genotypic frequencies of random mating populations.	6 hours
	Total Laboratory Hours	**30 hours**
Mode of evaluation:		
Recommended by Board of Studies	03-08-2017	
Approved by Academic Council	No.46	No. 23-08-2017

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Course code	Course Title	L	T	P	J	C
BIT1007	Microbiology	2	0	2	4	4
Pre-requisite	NIL	Syllabus version				
		2.10				

Course Objectives:

1. Build knowledge and skill in isolation, identification, cultivation, multiplication and preservation of microorganisms
2. Demonstrate the expertise in handling and controlling of microorganisms in labs as well as in various industries.
3. Illustrate the microbial knowledge in day to day life

Expected Course Outcome:

1. Distinguish and compare microorganisms
2. Categorize, screen and preserve the industrially exploited microbes
3. Classify and grow microorganisms by using various culture media
4. Evaluate, control and inhibit the bacterial growth
5. Analyze the bacterial infection and contamination
6. Demonstrate the practical skills by using various microbiology tools

Student Learning Outcomes (SLO):	2,4,11

Module:1	World of microorganisms	3 hours

Historical development of Microbiology as applied engineering science , microbial nutrition and role of major, minor elements

Module:2	Tools in Microbiology	4 hours

Microscopy – different types of microscopes and micrometry, types of media, enrichment techniques for screening and cultivation of microorganisms, maintenance and preservation of microbial cultures.

Module:3	Bacterial Morphology	3 hours

Prokaryotes and eukaryotes – bacteria types and cell components and staining techniques.

Module:4	Microbial Taxonomy	4 hours

Classification of microorganisms — bacterial classification schemes and identification methods (special note to Actinobacteria), Fungal classification and key identification characters. Algal characteristics, groups, and classification. Viruses – types, classification and characters. Sources

of microorganisms - Microbial Type Collection Centres in India and abroad.			
Module:5	**Microbial Metabolism**		**5 hours**
Respiratory metabolisms of microorganism – aerobic and anaerobic paths of energy production. Fermentative pathways – organisms, substrates, intermediates and end products. Storage polymers and excretory metabolism. Membrane transport – nutrient uptake and protein secretion in bacteria.			
Module:6	**Microbial Growth**		**5 hours**
Definition, cell division in microbes, factors affecting growth, techniques for measurements of growth and enumeration, Batch culture, continuous culture and synchronous growth; growth phases and growth curves - Chemostat, Turbidostat. Filamentous growth and measurement. Control of growth, principles, physical and chemical agents - their mode of action and application.			
Module:7	**Applied Microbiology**		**4 hours**
Microorganisms as human pathogens – role of bacteria, fungi and viruses in human diseases – Recent out breaks and various detection methods. Aquatic microorganisms – water testing and biological analysis – Industrial microbes			
Module:8	**Contemporary issues:**	**2 hours**	
Lecture by Industrial Expert			
	Total Lecture hours:	**30 hours**	

Text Book(s)	
1.	Black, 2016.Text book of microbiology. Freeman Publishers
Reference Books	
1.	Pelczar MJ, Chan ECS and Krieg. NR. Microbiology, Tata MCGraw Hill Edition, New Delhi, India
2.	Ananthanarayan, CK JayaramPanikars. Text book of Microbiology, 2005, Orient BlackswanPublishers
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

List of Challenging Experiments (Indicative)		
1.	Light and electron microscopy (components, principle and working mechanism of microscope)	3 hours
2.	Morphology of bacteria, fungi and algae	3 hours
3.	Simple and Differential staining - Gram's staining, Endospore staining, Negative staining and Hiss staining.	3 hours

4.	Micrometry –measurement of bacteria	3 hours
5.	Preparation and sterilization of media and glassware	3 hours
6.	Screening and cultivation of microorganisms by serial dilution and pour plate technique	3 hours
7.	Streak plate technique and single spore isolation	3 hours
8	Biochemical tests for identification of microorganisms	2 hours
9	Antibiotic profiling of microorganisms and Kirby-Bauer Test	3 hours
10	Growth of microorganism under shake flaks culture –generation and Doubling time determination	2 hours
11	Water testing –MPN count	2 hours
	Total Laboratory Hours	**30 hours**

Mode of evaluation:			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Course code	Course Title	L	T	P	J	C
BIT 1008	Principles of Chemical Engineering	3	0	2	0	4

Pre-requisite	NIL	Syllabus version
		2.0

Course Objectives:

1. Apply the principles of Chemical Engineering in a variety of employment areas.
2. Examine the experimental methods using sophisticated instruments and interpretation of experimental data.
3. Construct the conceptual design of equipment involved

Expected Course Outcome:

1. Apply the fundamental principles of chemical engineering
2. Examine Stoichiometry fundamentals and solve equations in relation to basic chemical engineering principles.
3. Infer the importance of sustainable and environmental considerations in chemical processes.
4. Evaluate the basic requirements and principles of process plant layout and design
5. Develop and interpret engineering application
6. Illustrate the applications of Chemical engineering in various industries

Student Learning Outcomes (SLO):	1,2,6

Module:1	Introduction	6 hours

Basic Chemical calculations, Gases-Ideal gas law, other equations of state, Gas mixtures, Gas-liquid mixtures, Partial molar properties - Dalton's Law and Amagot's Law, Partial pressures and density calculations.

Module:2	Material Balances without Chemical reactions	6 hours

Filtration, Mixing, Evaporation, Distillation and Fermentation.

Module:3	Material Balances with Chemical reactions:	6 hours

Processes involving chemical reactions: Conversion, Yield and Selectivity calculations.

Module:4	Energy Balance	6 hours

Basic Energy Concepts, Internal energy, KE and PE, Enthalpy, Heat capacity, Heat capacity of gases at constant volume and constant pressure conditions, Heat capacity of gaseous mixtures.

Module:5	Application of Energy Balance	5 hours

Energy Balance Equations - Steady state steady flow process, Application of energy balance in Bioprocesses – ethanol fermentation, Citric acid production and downstream processing.

Module:6	Dimensional Analysis	7 hours

Introduction, derived quantities, homogeneity, methods of dimensional analysis, Rayleigh's method and Buckinghams ∏ theorem, Numericals, Concepts of Similarities.			
Module:7	**Fluid properties and Fluid Transport**		**7 hours**
Specific weight, specific volume, specific gravity, viscosity, Newtons law of viscosity, Types of fluids, Pressure and its measurement – Simple manometer, U-tube manometer and differential manometer. Methods of describing fluid motion, types of fluid flow, rate of flow, continuity equation, Bernoullis theorem, Flow Measurement Devices – Orifice and Venturimeter, Pumps and Valves.			
Module:8	**Contemporary issues:**		**2 hours**
Lecture by Industrial Expert			
	Total Lecture hours:	**45 hours**	

Text Book(s)

1.	Pauline M. Doran. Bioprocess Engineering Principles. Second Edition. Academic Press, 2013

Reference Books

1.	S. Pushpavanam, Introduction to Chemical Engineering, PHI Learning Pvt. Ltd., 2012
2.	Bhatt B. I and S.M. Vora Stoichiometry Tata McGraw Hill, 4th Edition, 2004.
3.	McCabe RL & J.C Smith "Unit operations of Chemical Engineering" McGraw Hill International Editions, 2001.
4.	Himmelblau D.M., Basic Principles and Calculations in Chemical Engineering, Prentice Hall, 2004
5.	Bansal R.K., Fluid Mechanics and Hydraulic Machines , Laxmi Publications, Ninth Edition, 2015

Mode of evaluation: Use of technology in teaching, lecture by industry experts**,** Written examinations, assignments and quizzes			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Course code	Course Title	L	T	P	J	C
BIT 2004	Bioinformatics	2	0	2	0	3
Pre-requisite	BIT1005	Syllabus version				
		2.10				

Course Objectives:

1. To introduce the basic concepts, methods and tools employed in Bioinformatics.
2. To solve biological problems using bioinformatics tools
3. Emphasis will be given to the application of bioinformatics and biological databases to problem solving in real research problems.

Expected Course Outcome:

1. Apply knowledge of the basic concepts of biology, computer science and mathematics
2. Use the information in computer modeling
3. Appraise structure-function relationships, database queries
4. Develop methodologies to rapidly reach the frontier of bioinformatics
5. Formulate biological big data to unlock the next big biotech discovery
6. Interpret sequence analysis results and what functional regions mean biologically

Student Learning Outcomes (SLO):	2,7

Module:1	Biological database:	5 hours

General Introduction of Biological Databases – Nucleic acid databases, Protein databases, Structure databases - File Format - Genbank, DDBJ, UniProt and PDB.

Module:2	Sequence alignment:	5 hours

Introduction to Sequences alignments - Dot plot and Dynamic Programming - Local alignment - Smith-waterman algorithm - and Global alignment - Needleman-Wunsch - (algorithm and example) –sequence formats.

Module:3	Multiple sequence alignment:	5 hours

Gap penalty, types, substitution scoring matrices, multiple sequence alignment – Clustal W algorithm - Feng Doolittle algorithm, star method, PSSM, Sequence logos, applications.

Module:4	Heuristic methods:	4 hours

Similarity Searches on Sequence Databases - Heuristic Sequence Alignment -BLAST and its types, FASTA – Algorithms -Sensitivity, specificity, applications

Module:5	Molecular Phylogenetics:	4 hours

Distance based method - Character-Based Methods- Phylogenetic Tree Evaluation – Jackknifing and Bootstrapping - applications.

Module:6	Structural Bioinformatics:	3 hours

Conceptual model of protein structure, protein structure prediction - Homology modeling,

Threading & *Ab initio* methods.			
Module:7	**Pharma-informatics:**		**2 hours**
Bioinformatics in the Pharmaceutical Industry- Computer aided Drug design and discovery - scope and application of Bioinformatics.			
Module:8	**Contemporary issues:**		**2 hours**
Lecture by Industrial Expert			
	Total Lecture hours:	**30 hours**	

Text Book(s)	
1.	Arthur Lesk, Introduction to Bioinformatics, 2014, 4th Edition, Oxford University Press, UK.
Reference Books	
1.	Jamil Momand, Concepts in Bioinformatics and Genomics, 2016, 1st Edition, Oxford University Press, UK
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

List of Challenging Experiments (Indicative)		**SLO: 8,14,17**
1.	Nucleotide sequence from primary nucleotide database	2 hours
2.	Protein sequence from protein database	2 hours
3.	Protein structure from structure database	2 hours
4.	Access of secondary biological data from various Biological database	2 hours
5.	Pairwise alignment using dot plot	2 hours
6.	Pairwise alignment using dynamic programming	2 hours
7.	Heuristic Sequence Alignment using BLAST/ FASTA	3 hours
8.	Multiple sequence alignment	3 hours
9.	Construction of Phylogenetic tree	3 hours
10.	Gene prediction analysis	3 hours
11.	Prediction of secondary structure of protein	3 hours
12.	Visualization of protein Structure	3 hours
	Total Laboratory Hours	**30 hours**

Mode of evaluation:			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Course code	Course Title	L	T	P	J	C
BIT 2005	Analytical Techniques in Biotechnology	3	0	4	0	5
Pre-requisite	BIT 1005	Syllabus version				
		2.10				

Course Objectives:

1. To impart knowledge and skills in using various analytical instruments
2. Expertise of the concepts, principles and contemporary issues
3. Illustration and analysis of techniques and skills of modern Bio engineering instruments

Expected Course Outcome:

1. Define and relate the standard operating techniques of various instruments.
2. Compare and optimize instrumentation for bioassays
3. Interpret and identify the principle and applications of biological instruments
4. Examine test samples to know the error and for standard analysis
5. Experiment with analytical instruments for bimolecular estimations and their result analysis
6. Impart the knowledge of molecular Biology Techniques

Student Learning Outcomes (SLO): 2,14

Module:1	**Analytical Lab – Lab components** –	7 hours

GLPs – Standard Operating Procedures - Documentation - record maintenance. Laboratory and Notebooks - Specifications and Report Sheets Analytical Methods and Validations- -Calibration Maintenance Logs. Sampling – methods and techniques –heterogeneity and random sampling, Sample reduction techniques sources of error in experimental results, precision, accuracy, determinate and indeterminate errors.

Module:2	**Qualitative and quantitative analysis**:	6 hours

Titrimetric and volumetric analyses – Kjeldahl's method of N estimation. Mass analyses – gravimetric techniques - pH meter principles and components - potentiometric titration - principles and components conductivity meter and conductimetric titration

Module:3	**Spectrophotometry** :	7 hours

working principle, instrumentation, sample preparation and its applications and types(UV –VIS, AAS, AES, Spectroflurometry)

Module:4	**IR, MS & NMR Spectroscopy**:	8 hours

Principles, instrumentation, sample preparation and applications of IR, FTIR, interpretation of IR spectra, Mass spectrometer- Basics and instrumentation, applications. Nuclear magnetic resonance (NMR) – Basics and instrumentation and applications. Interpretation of Mass spectra and NMR

Module:5	**Electrophoresis**:	4 hours

Theory of electrophoresis and types of electrophoresis zonal, moving boundary and pulse field – their principles and applications. Capillary electrophoresis, 2D. Optical densitometry

Module:6	**Chromatography**	5 hours

Theory of Chromatography and types (Paper, TLC, HPTLC, column, GC, HPLC) – their principles and applications		
Module:7	**Tracer techniques and Recent analytical tools**	**6 hours**
Scintillation Solid and Liquid principle, instrumentation and applications - strengths and limitations. Alternative to radioactive substances. Instrumentation and data analysis High through put screening systems, MRI, Digital imaging, Liquid handling systems, Microarrays.		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)

1.	Keith Wilson and John Walker Principles and Techniques of Biochemistry and Molecular Biology, Sixth Edition 2015

Reference Books

1.	Fifield F.W., 2016. Principles and Practice of Analytical Chemistry. Blackwell, Scientific Publishers.
2.	AvinashUpadhyay; KakoliUpadhyay; NirmalenduNath 2015 Biophysical chemistry: (principles and techniques) Himalaya Pub. House Mumbai.
3.	Nag, A. 2016. Analytical Techniques In Agriculture Biotechnology And Environmental Engineering. Prentice Hall India, New Delhi.
4.	Philopose P.M. 2016. Analytical Biotechnology. Domihant Publishers & distributors, New Delhi.
5.	Lack, C. 2015. Ewing`s analytical instrumentation handbook. Marcel and Dekker Inc.
6.	Boyer, Rodney F. 2015 Biochemistry laboratory: modern theory and techniques. 2nd edition

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Challenging Experiments (Indicative)

1.	Maintenance of Lab Notes and Records; Good Laboratory Practices; Standard Operating Procedure (SOP). I) Calibration of volumetric apparatus using water. ii) Preparation of some standard alkali and acid solutions.	2 hours
2.	Estimate the strength of ammonia solution by back titration using strong acid	2 hours
3.	Study the effect of end point determining tools (pH meter, conductivity meter and chemical indicator) in a strong acid strong base titration and their accuracy and precision analysis.	2 hours

4.	Find out the physical parameters such as turbidity, pH, and conductance of various water sample and simulated field liquid samples.	2 hours
5.	Determine the amount of phosphate in soft drinks.	2 hours
6.	Estimation of protein in day today samples by using UV-Vis Spectrophotometer.	4 hours
7.	Separation of sugars and amino acids by using paper and thin layer chromatography.	4 hours
8.	Determine the effect of pH on electrophoretic separation of proteins using agarose gel.	4 hours
9.	Study the effect of PAGE concentration on the resolution of separation of protein samples.	4 hours
10.	Demonstration and data analysis of IR Spectrophotometer, NMR, HPLC and GC-MS.	2 hours
11.	Determination of acetylsalicylic acid content in aspirin tablets.	2 hours
	Total Laboratory Hours	**30 hours**

Mode of evaluation:			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Course code	Course Title	L	T	P	J	C
BIT 2006	Molecular Biology	3	0	2	0	4
Pre-requisite	BIT 1005	Syllabus version				
		2.10				

Course Objectives:

1. Illustrate the molecular concepts of life
2. Learn the organization and function of DNA, RNA and proteins
3. Explain the regulation of biological processes

Expected Course Outcome:

1. Appraise key concepts, facts, and theories relevant to biological macromolecules
2. Assess the contemporary issues in related field
3. Correlate the different steps in translation of genetic information.
4. Propose solutions to address the biotechnological problems.
5. Evaluate and examine recent developments in the subject.
6. Compare and analyze biological samples and data presented in pictorial or numerical form.

Student Learning Outcomes (SLO):	2,11

Module:1	Central dogma of molecular biology	8 hours

Chromosomal Structure and packing, DNA replication and models of replication, Cairn's experiment, Meselson and Stahl' experiment, semi conservative replication, DNA or RNA as the genetic material

Module 2	Structure and function of gene	6 hours

Gene, Cistron, Muton, Recon, Regulator elements of gene: Promoter, Operator, Repressor, Inducer, examples, lactose operon, tryptophan operon

Module:3	Transcription	6 hours

Structure of RNA Polymerase, events occurring in the promoter region, mechanism of mRNA synthesis: initiation, elongation and termination, transcription cycle

Module:4	Post transcriptional modifications	5 hours

Processing of mRNA, splicing, introns, exons, reading frame, alternate splicing, processing of tRNA and rRNA, structure of tRNA and ribosomes

Module:5	Genetic code and amino acids	4 hours

Features and deciphering of the genetic code

Module:6	Translation	6 hours

Polypeptide chain initiation, elongation and chemistry of polypeptide chain; termination, role of non-ribosomal proteins in translation, coupled transcription and translation		
Module:7	**Post translational modifications**	**8 hours**
Post translational modifications of the polypeptide chain: processing and folding; inhibitors of replication, transcription, translation, reverse transcription: plus strand, minus strand, reverse transcription process, reverse transcriptase sources and functions, inhibitors of recombination		
Module:8	**Contemporary issues**	**2 hours**
Lecture by an Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)

1.	Arnold Berk , Chris A. Kaiser , Harvey Lodish , Angelika Amon, HiddePloegh, Anthony Bretscher, Monty Krieger, Kelsey C. Martin. 2016. Molecular Cell Biology, 8th edition, W.H. Freeman. USA.
2	Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts and Peter Walter. 2014. Molecular Biology of the Cell. 6th edition. Garland Science, USA.

Reference Books

1.	David L. Nelson and Michael M. Cox. 2017. Lehninger Principles of Biochemistry: International Edition. 7th edition, W.H. Freeman. USA.
2.	Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick. 2017. Lewin's GENES XII. 12th revised edition. Jones and Bartlett Publishers Inc., USA.
3.	Michael R. Green and Joseph Sambrook. 2012. Molecular Cloning A Laboratory Manual. 4th edition. Cold Spring Harbor Laboratory Press. USA.

List of Challenging Experiments (Indicative)

1.	Design of a Molecular Lab / instrumentation / Good Laboratory Practices (GLP)	2 hours
2.	Micropipette usage and calibration Methods	2 hours
3.	Preparation of Reagents, stock solutions and calculations	2 hours
4.	Bacterial Genomic DNA isolation	2 hours
5.	Yeast Genomic DNA isolation	2 hours
6.	Human Genomic DNA isolation	4 hours
7.	Plant Genomic DNA isolation	4 hours
8.	Total cellular RNA isolation and analysis by formaldehyde gel	4 hours
9.	Analysis of DNA and RNA by Spectrophotometry	2 hours

10.	Protein extraction and SDS-PAGE Analysis		4 hours
11.	Protein analysis by Native- PAGE		2 hours
		Total Laboratory Hours	**30 hours**
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Vellore Institute of Technology
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Course code	Course Title	L	T	P	J	C
BIT 2007	Downstream Processing	2	1	2	0	4
Pre-requisite	BIT1005, BIT1007	Syllabus version				
		2.10				

Course Objectives:

1. To apply the fundamental concepts of bio separation engineering.
2. To learn and design a downstream processing for product isolation and purification.
3. To recognize and troubleshoot problems associated with purification of bio products.

Expected Course Outcome:

1. Assess the significance of downstream processing in a bio- product separation.
2. Apply the knowledge of unit operations for the separation of insoluble from fermentation broth.
3. Propose and design recovery and purification of biomolecules by applying concepts of mass transfer operation.
4. Examine skills needed to function in modern bio separation engineering.
5. Design and demonstrate adsorption and chromatography processes for the purification of bio molecules.
6. Demonstrate the skills and techniques to design a process for product purification.

Student Learning Outcomes (SLO):	5,14,17

Module:1	Introduction to schematics of downstream processing:	3 hours

Range and characteristics of bio products, Characteristics of Fermentation Broth, Selection of unit operation with due consideration of physical, chemical and biochemical aspect of biomolecules, Stages of Downstream Processing.

Module:2	Cell disruption techniques:	3 hours

Mechanical and Non-mechanical methods of cell disruption, Mechanical Cell disruption methods- Cell disruption kinetics for a bead mill and high-pressure homogenizer.

Module:3	Separation of insoluble from fermentation broth:	7 hours

Flocculation and sedimentation, Centrifugation-Laboratory and preparative centrifuges, differential and density gradient centrifugation. Filtration: Theory of Filtration for incompressible and compressible cakes, Pre-treatment of fermentation broth, Filter media and equipment for batch and continuous Filtration.

Module:4	Extraction and Precipitation	10 hours

Extraction processes - solvent extraction principles, operating modes of extraction, Extraction of biomolecules by aqueous –aqueous, aqueous two-phase, reverse micellar, and supercritical fluid extraction. Colloidal stability of protein solutions, precipitation of biomolecules by isoelectric, salting out, organic solvent , non-ionic polymers, Poly- electrolyte addition and selective denaturation of unwanted proteins

Module:5	Membrane separation processes:	6 hours

Basic principles and advantages, Modes of operation, Pressure-driven processes (MF, UF, NF & RO), Concentration-driven processes (Dialysis &Pervaporation), and Electrically-driven processes (Electro dialysis); Applications of the different types of membrane separation processes		
Module:6	**Chromatographic separation processes**	**8 hours**
Module:7	**Finishing Operations:**	**6 hours**
Crystallization, Drying, Lyophilization and Formulation, Industrial-scale Crystallizers and Dryers		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)

1.	Raja Ghosh (2006) Principles of Bio separation engineering, World Scientific Publishing Co Pte Ltd
2.	Ladisch, M.R., (2001), Bio separation Engineering: Principles, Practice and Economics, Wiley, Interscience

Reference Books

1.	Bioseparations - Principles and techniques, B. Sivasankar, Prentice Hall of India, N Delhi, 2005, pp 280
2.	Product recovery in Bioprocess technology (1992) Butterworth- Heinemann, Biotol series.
3.	Mukesh D, Gaikar V and Anil Kumar Biotransformation's& Bioprocesses, Marcell Dekker, New york,(2004).

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Challenging Experiments (Indicative)

1.	**A: Partial purification of intracellular/ extracellular products from microbial /plant source** - Extraction of intracellular metabolites by cell lysis.	2 hours
2.	Concentrating the intracellular extract by membrane filtration.	1 hour
3.	Separation of proteins based on the solubility by precipitation using salt.	4 hours
4.	Removal of salt from the protein solution and buffer exchange by dialysis.	2 hours
5.	**B: Isolation of carbohydrate digesting enzymes from cereal kernels –** Drying ; milling and solid-liquid (aqueous) extraction	2 hours
6.	Separation of proteins using liquid-liquid extraction – Aqueous two phase /	6 hours

	reverse micellar process	
7	Separation of metabolites based on molecular mass - gel filtration	2 hours
8	Separation of proteins based on surface charge density – ion exchange chromatography	2 hours
9	Concentration / drying of protein solution – lyophilization	2 hours
10	**C: Separation of pigments from selected flowers** -Use of organic solvent extraction for separating the metabolites	2 hours
11	Use of adsorption as the sample enrichment aid	4 hours
	Total Laboratory Hours	**30 hours**
Mode of evaluation:		
Recommended by Board of Studies	03-08-2017	
Approved by Academic Council	No. 46	Date 24-08-2017

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Course code	Course Title	L	T	P	J	C
BIT 2008	Immunology And Immunotechnology	3	0	2	0	4
Pre-requisite	BIT 1007	Syllabus version				
		2.10				

Course Objectives:

1.To explain the basics of immune system in humans and cellular mechanisms involved
2.To demonstrate the different immune systems in determining infection and immunological disorders including tumor
3.To translate the concepts in better diagnosis of diseases and their probable treatment

Expected Course Outcome:

1. Relate various immunological components in body's defence mechanism
2. Appraise of cellular functions in monitoring immunity
3. Make use of cellular activity in defining immune system
4. Translate the immune mechanisms in determining infection and immunological disorders
5. Development of different diagnostic techniques and applications
6. Appraisal of different therapeutic techniques and applications

Student Learning Outcomes (SLO):	2,11,18

Module:1	Immune system:	6 hours

An overview & significance of immunology. **Hematopoiesis:** Origin and differentiation of Lymphocytes and phagocytic cells- receptors and signals that control lymphocyte lineage commitment. Cytokines.Cells and tissues of the immune system-Lymphoid organs

Module:2	Immunity types:	5 hours

Innate and acquired immunity. Elements of Immunity – B lymphocytes and thymus derived (T) Lymphocytes. Immunogens and antigens, complement system

Module:3	Humoral& Cellular Immunity:	8 hours

Immunoglobulins - Classes and subclasses, organization and expression of immunoglobulin genes. Immunoglobulin gene rearrangement –antibody diversity – B-cell development & activation. TCR, TCR diversity, T cell receptor gene rearrangement. T-cell development & activation

Module:4	Antigen processing and presentation:	5 hours

Classes of MHC – MHC/HLA genetic loci. Molecular structure and assembly of MHC molecules, Antigen presenting cells- antigen processing and presentation.

Module:5	Immunity to infection, Hypersensitivity Reactions and autoimmunity:	6 hours

An overview of immune response to infections, Hypersensitivity reactions, Immunological tolerance- B & T cell tolerance. Autoimmunity: - an overview of the immunopathogenic mechanisms of autoimmunity.

Module:6	Immunology of tumors and transplantation:	6 hours

Tumors: Immune response to tumors-types of tumor antigens. Transplantation: Types, immunological mechanisms of graft rejection- immunological strategies to prevent graft rejection-role of immunosuppressive drugs.		
Module:7	**Immunotechnology:**	**7 hours**
Hybridoma technology - Production and purification of monoclonal antibodies; polyclonalantibodies Antibody engineering. Immunotechniques: ELISA, ELISpot, Immuno fluorescence, Flow Cytometry, immunohistochemistry **Immunodiagnostics &immunotherapeutics:** Current trends & applications		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)

1. Goldsby. R.A, Kindt.T.J, Kuby J and Osborne BA, Immunology, 7th Eds. W.H. Freeman Pubn. New York 2014.
2. Abbas K A, Litchman A. H. Cellular and Molecular Immunology. 8th Eds., W. B. Saunders Co. 2015
3. Judy Owen , Jenni Punt , Sharon Stranford , Patricia Jones Kuby, immunology 88th Eds. W.H. Freeman Pubn 2018.

Reference Books

1. Roitt I.M., Brostoff. J, Male. D.K. Immunology, 7th B. K. &Cdreds, Garland Pub Ltd. 2014.
2. C. A. JanewayJr, P. Travers. Immunobiology, 8th Ed, Lecture spring Pub. 2014.
3. R.M. Coleman, M.F. Lombard, R.E.Sichard. Fundamental Immunology, 5th Ed- Bookbarn International 2014

List of Challenging Experiments (Indicative)

1.	Cells and Organs of Immune System: Purpose: a. To examine the cells that comprise the immune system (counts and morphology) b. To examine location or organs and tissues of immune system (primary and secondary) c. To examine morphology of immune organs and tissues.blood components, serum preparation, plasma preparation, Complement inactivation of serum	3 hours
2.	Complement fixation test: (using test sera collected with and without complement).	3 hours
3.	Antigen preparation: Bacterial LPS/ whole cell lysate/ egg white albumin	3 hours
4.	Immunization: Animal handling, inoculation of antigens to raise antibodies	3 hours
5.	SDS-PAGE: (visualizing Ag,Ab):Antibody (standard), serum, prepared antigen, polyclonal antibodies raised. Enzymatic digestion of antibody	3 hours
6.	Purification of antibodies: Collection of blood from immunized animal, antiserum preparation, purification of IgG and storage of polyvalent serum.	3 hours
7.	Serotyping: Slide, tube agglutination & latex agglutination	3 hours

8.	Precipitation assays:Immunodiffusion / immunoelectrophoresis	3 hours
9.	Antibody Labeling: Labeling of IgG with HRP/AP and ELISA	3 hours
10	Western blotting	3 hours
	Total Laboratory Hours	**30 hours**

Mode of evaluation:			
Recommended by Board of Studies	18-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

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Course code	Course Title	L	T	P	J	C
BIT 2017	Industrial Biotechnology	3	0	0	4	4
Pre-requisite	BIT 1007				Syllabus version	
						2.10

Course Objectives:

1. To provide fundamental insights about strain improvement, different bioreactors, its types and operation methods.
2. To design and optimize medium formulation and sterilization for industrial fermentation process.
3. To comprehend the industrial method of fermentation for various primary and secondary metabolites and biocatalysts.

Expected Course Outcome:

1. Design their own reactor model and setup based on the requirement
2. Knowledge of basics in metabolic stoichiometry and its calculations
3. Understand and appreciate the methods to improve the strains required for the production of bioproducts
4. Optimize and formulate medium using statistical tool for the maximum production of metabolites and biocatalyst
5. Learn to perform the design of thermal and filter sterilization process
6. Understand the overall fermentative productions of representative metabolite, biocatalysts and biospecialty products.

Student Learning Outcomes (SLO): **6, 14, 17**

Module:1	Introduction to Industrial Biotechnology:	6 hours

History of Industrial biotechnology, Process flow sheet and types of bioreactors.

Module:2	Metabolic Stoichiometry:	6 hours

Stoichiometry of Cell growth and product formation, elemental balances, degrees of reduction, yield coefficients of biomass and product formation and heat evolution in aerobic cultures.

Module:3	Strain Improvement:	6 hours

Techniques of strain improvement- Random mutation, Auxotrophic mutation, rDNA technology and protoplasmic fusion.

Module:4	Medium formulation and optimization:	6hours

Medium requirements for fermentation processes, carbon, nitrogen, inducers, precursors, inhibitors, antifoaming agents and other complex nutrients. Medium optimization by classical method and statistical method- PlackettBurman and Response surface method

Module:5	Sterilization:	6 hours

Batch and continuous thermal sterilization, Thermal death kinetics and design of batch and continuous sterilization. Filter sterilization of air and medium.			
Module:6	**Primary metabolites:**		**6 hours**
Production of commercially important primary metabolites like citric acid, ethanol, acetic acid, glutamic acid and lysine.			
Module:7	**Secondary metabolites:**		**7 hours**
Production of commercially important secondary metabolites like antibiotics (penicillin), vitamins (cyanocobalamine)**,** alkaloids (ergot) and steroids **Other Bioproducts:** Production of commercially important bioproducts like biopreservative (nisin), biopolymer (xanthan gum), biofertilizers and biopesticides.			
Module:8	**Contemporary issues:**		**2 hours**
Lecture by Industrial Experts			
	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	Peter Stanbury, Principles of Fermentation technology 2015, third edition, Butterworth-Heinemann
2.	Wulf Crueger, Anneliese Crueger, Thomas Dale Brock (2005) Biotechnology: A Textbook of Industrial Microbiology, 2nd edition Sinauer Associates Inc., U.S
Reference Books	
1.	Michael L. Shuler, Fikret Kargi, Matthew De Lisa (2017). Bioprocess Engineering, 3rd Edition, Prentice Hall International Series.

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

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Course code	Course Title	L	T	P	J	C
BIT 2020	Chemical Reaction Engineering and Unit Operations	2	1	0	0	3
Pre-requisite	BIT1008	Syllabus version				
		1.1				

Course Objectives:

1. To apply the knowledge from the calculus, differential equation, thermodynamics, material and energy balances to solve reactor design problems
2. To design chemical reactors with associated cooling and heating equipment
3. To equip students with necessary skills to enable them to comprehend and troubleshoot challenges related to designing/ operating process equipment.

Expected Course Outcome:

1. Develop the rate laws for different reactions.
2. Design of reactors and heat exchange equipment.
3. Compile and interpret data and deduce detailed conclusion from the calculation.
4. Compare, evaluate and examine the relevance of various process equipment designed for biological processing.
5. Pursue and plan R&D activities in reactor design and their applications in bio-industry.
6. Identify, formulate and solve engineering problems associated with small-scale and large-scale bioprocesses.

Student Learning Outcomes (SLO):	2,5,9

Module:1	Kinetics	6 hours

Definition of reaction rate; Kinetics of homogeneous reaction: Concentration-dependent term of a rate equation, single and multiple reactions, rate equation from given mechanisms. Elementary & Non-elementary reactions, Molecularity and order of reaction, Representation of reaction rate, Kinetics for elementary reactions related problems, Temperature dependent term of a rate equation.

Module 2	Interpretation of batch reactor data	6 hours

Constant-volume batch reactor, Integral method of analysis of data: General Procedure, Irreversible unimolecular-type first-order reaction, Irreversible bimolecular-type second-order reactions, rate equation for enzymatic reaction, Zero-order reactions, Over-all order of irreversible reactions from the Half-life method, Initial rate method of analysis. Irreversible reactions in parallel, Autocatalytic reactions, Irreversible reactions in series and First-order Reversible Reactions.

Module:3	Differential method of Analysis of data	6 hours

Analysis of the Complete Rate Equation, Partial analysis of rate equation, Variable-Volume reaction system: Its Integral method of analysis for Zero-order reactions, First order reaction and Second-order reactions.

Module:4	**Single ideal Reactors**	**6 hours**
Basic division of ideal reactors, ideal batch reactor, design equation of batch reactor, concept of flow reactors, space-time and space-velocity, Steady-state Mixed Flow Reactor: Design Equation, Graphical Representation of Design Equation		
Module:5	**Steady-state Plug Flow Reactor**	**6 hours**
Design equation or performance equation of plug flow reactor, graphical representation in terms of concentration and conversion.		
Module:6	**Design for Single Reactions**	**6 hours**
Size and comparison of single reactors: Batch Reactor, PFR, MFR, General Graphical Comparison		
Module:7	**Unit Operations**	**7 hours**
Introduction, classification, performance and application of types of heat exchanger, Different methods of heat exchange, Design of Heat Exchanger, Estimation of heat exchange area. **Drying**: Introduction, classification, Theory of drying, drying rate, drying of biological material, drying equipment, conventional and freeze drying		
Module:8	**Contemporary issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)

1. Treybal RE (2012) Mass Transfer Operations, 3rd Edition, McGraw-Hill.
2. Warren McCabe, Julian Smith, Peter Harriott (2005) Unit Operations of Chemical Engineering, McGraw Hill Chemical Engineering Series 7th Edition.

Reference Books

1. Pauline M Doran (2013) Bioprocess Engineering Principles. 2nd Edition. Academic Press.
2. Alan S. Foust, Leonard A. Wenzel, Curtis W. Clump, Louis Maus, L. Bryce Andersen (2008) Principles Of Unit Operations, 2Nd Ed, John Wiley & Sons
3. Theodore L Bergman, Adrienne S Lavine, Frank P Incropera, David P DeWitt (2011) Fundamentals of Heat and Mass Transfer, 7th Edition, Willey.

Mode of Evaluation: Written examinations, assignments and quizzes

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

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Course code	Course Title	L	T	P	J	C
BIT 3006	Genetic Engineering	3	0	2	0	4
Pre-requisite	BIT 2006	Syllabus version				
		2.10				

Course Objectives:

1.To demonstrate the components required for gene manipulation
2.To apply the knowledge of genetic material and their transformation at molecular and cellular levels, and
3. To create and construct new genetic material and transgene organisms.

Expected Course Outcome:

At the end of the course, student will be able to:
1. Design construct the recombinant vector and develop genetically modified organisms.
2. Describe the pros and cons of GMOs
3.Apply concepts of gene cloning principles,
4. Restate the commercialization potentials of tool enzymes
5. Explain genome or pDNA mapping,
6. Paraphrase various methods to transfer foreign genes

Student Learning Outcomes (SLO):	2

Module:1	Concept of genetic engineering	6 hours

Steps involved in gene cloning, chimera, industrial applications, GMOs. GM products

Module:2	Tool enzymes	6 hours

Nucleases, type II restriction endonucleases, single and double digestion, restriction mapping polymerases, ligases, DNA modifying enzymes, topoisomerases.

Module:3	Cloning vectors	6 hours

Prerequisite features, plasmids – pBR322, pUC, lambda phage DNA as a vector, M13, cosmid vectors, BAC, YAC, and PAC

Module:4	Candidate gene isolation methods	6 hours

Genomic DNA library preparation, cDNA library preparation, gene pulling by PCR, primer and probe design, invitro expression and regulation of cloned genes

Module:5	Gene transfer methods :	6 hours

Physical, chemical and biological methods of transformation. *Agrobacterium* mediated gene transfer – Ti plasmid, Ri plasmid

Module:6	**Selection and screening methods**	**6 hours**
Antibiotic and non-antibiotic selection markers, reporter genes and their applications, GFP RFP and screening methods, importance and *in vitro* bioassay.		
Module:7	**PCR and Molecular Markers**	**7 hours**
Principle, components, types of PCR and applications of PCR, advantages and limitations of PCR. **DNA molecular markers and finger printing**: RAPD, RFLP, AFLP and SSR. Applications in identification of individuality. Safety and ethical issues		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)

1. Primrose, S.B. and Twyman, R.M., 2012. Principles of Gene Manipulation and Genomics. 8th Edition, Blackwell Publishing Co. UK
2. T. A. Brown, 2016 Gene Cloning and DNA analysis: An introduction. 7th Edition, John Wiley and Sons Ltd. UK

Reference Books

1. Dominic W.S. and Wong, 2015. The ABCs of Gene Cloning, 2nd Edition, Springer International, The Netherlands.
2. Christopher Howe, 2015. Gene Cloning and Manipulation, 2nd Edition, Cambridge University Press, UK

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Challenging Experiments (Indicative)		
1.	Plasmid DNA Isolation and analysis	3 hours
2.	Competent cell preparation	2 hours
3.	Transformation and antibiotic selection or Blue white selection method	3 hours
4.	Restriction digestion with plasmid and lambda Phage DNA	2 hours
5.	Methods of Restriction mapping, using online NEB cutter tools	2 hours
6.	Ligation process (Joining of DNA)	2 hours
7.	Southern Blotting – Kit Demo	2 hours
8.	In vitro amplification of DNA by PCR or gene pulling by	6 hours
9.	GFP Cloning – Kit Demo	2 hours
10	RAPD	2 hours
11	DNA elution in agarose gel	2 hours
	Total Laboratory Hours	**30 hours**

Mode of evaluation:

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Course code	Course Tilte	L	T	P	J	C
BIT 3012	Bioprocess Engineering and Bioreactor Design	2	1	2	0	4
Pre-requisite	BIT 2020	Syllabus version				
		2.10				

Course Objectives:

1. To understand fundamental concepts of bioprocess engineering and bioreactor design.
2. To learn and understand mixing and mass transport for bioprocess operation.
3. To learn skills and technologies associated with upstream processing.

Expected Course Outcome:

At the end of the course, students should be able to:

1. Develop control strategies for bioprocess operations.
2. Apply reaction engineering principles for the operation of bioreactors.
3. Apply mass transfer concepts to design aeration and agitation for bioreactor operation.
4. Design a scale up and scale down process associated with bioprocess engineering.
5. Develop mathematical modeling for microbial growth.
6. Demonstrate technologies associated with upstream processes.

Student Learning Outcomes (SLO):	5, 6, 14

Module:1	Instrumentation and control of bioreactors:	6 hours

Accessories for monitoring and control of environmental parameters, accessories for aseptic operation, Control modes and types of controllers. Basic criteria for design of bioreactor

Module:2	Modes of operation of bioreactors:	8 hours

Batch operation (enzymatic and microbial), Continuous stirred tank , Continuous stirred tank with recycle- Fed batch and two-stage operation

Module:3	Oxygen transfer in bioreactors-I:	5 hours

Oxygen transfer to cells – transfer resistances – mass transfer coefficients – determination of oxygen transfer coefficients – Factors affecting mass transfer coefficient

Module:4	Oxygen transfer in bioreactors – II:	5 hours

Power requirement for mixing in aerated and non-aerated tanks, agitated and non-agitated tanks for Newtonian and non-Newtonian liquid. Mixing time in agitated reactor

Module:5	Scale – Up:	5 hours

Reactor scale up – Scale up criteria – Scale down

Module:6	Mathematical models for microbial growth:	6 hours

Mathematical models – types – Purpose – Unstructured models (Monod and others, Inhibition models); Product formation kinetics - Structured models - Model simulation

Module:7	Immobilized enzyme and cell reactor	8 hours

Immobilization – Techniques - Kinetics in immobilized reactors(Spherical particles) – Theile

modulus and effectiveness factor **Advances in reactor design:** Photobioreactors – Reactors for plant cells, animal cells and tissue engineering			
Module:8	**Contemporary issues:**		**2 hours**
Lecture by Industrial Expert			
	Total Lecture hours:		**45 hours**
Text Book(s)			
1.	Michael L. Shuler, FikretKargi, Matthew DeLisa (2017). Bioprocess Engineering, 3rd Edition, Prentice Hall International Series.		
2.	Pauline M Doran (2013) Bioprocess Engineering Principles. 2nd Edition. Academic Press.		
Reference Books			
1.	Peter Stanbury, Principles of Fermentation technology 2015, third edition, Butterworth-Heinemann		
2.	Shigeo Katoh and Fumitake Yoshida, Biochemical Engineering (2010), A Textbook for Engineers, Chemists and Biologists, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim		
List of Challenging Experiments (Indicative)			
1.	Batch submerged fermentation of yeast in shake flasks – Estimation of growth parameters and Kinetics		4 hours
2.	Design of media for growth and product formation enhancement using classical and statistical optimization methods.		6 hours
3.	Estimation of parameters for michealis-menten model		4 hours
4.	Immobilized Amylase Packed bed reactor – Kinetic study		4 hours
5.	Fed – batch cultivation for production of ethanol in pilot scale		4 hours
6.	Determination of mass transfer coefficient in a stirred tank reactor		4 hours
7.	Anaerobic fermentation for wine production		4 hours
		Total Laboratory Hours	**30 hours**
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

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Programme Electives

Course code	Course Title	L	T	P	J	C
BIT 1002	Biostatistics	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.1				

Course Objectives:

1. To expose the students about the role of statistics in biological sciences and engineering
2. To enable the students to design, analyze, present and interpret research data.

Expected Course Outcome:

1Ability to design experiments, sampling variables, analyze the biological data, interpret and present the results in meaningful way.
2. Create tables and graphs for data presentation
3. Describe measures of central tendency and dispersion along with calculating probability features of experiments.
4. Discuss the correlation between various types of data along with associated variables.
5. Test hypothesis and carry out related statistical tests
6. Formulate designs for biological experiments.
7. Evaluate and interpret practically, the data acquired in biological experiments, by the means of statistical methods.

Student Learning Outcomes (SLO):	1,2,4

Module:1	Descriptive methods	4 hours

Frequency Distribution, Characteristics of a Frequency Distribution, Tabular and Graphical Presentation of Data: Line Graphs, Bar Charts, Histograms, Ogives.

Module:2	Measures of central tendency	4 hours

Arithmetic Mean, Median, Mode, Position of Averages, Selection of the Appropriate Measure of Central Tendency, Geometric Mean, Harmonic Mean.

Module:3	Measures of dispersion	4 hours

Range, Interquartile Range, Mean Deviation, Variance and Standard Deviation, Skewness and Kurtosis, Box plots, Stem-and-Leaf Plots

Module:4	Probability	4 hours

Probability Definition, Rules for Calculating Probabilities, Bayes' Theorem, Binomial, Normal and Poisson
Distributions.

Module:5	Correlation and Regression	4 hours

Correlation, Karl Pearson correlation, Rank correlation, Dot Plots, Scatter Plots Regression analysis, least square assumption

Module:6	**Sampling Designs**	**4 hours**
Sampling and Sample Designs, Significance of Probability and Non-probability sampling methods, Crossover Design, Case Control Design, Cohort Study Design, Designing clinical trials - Single- and Double-Blind Experiments.		
Module:7	**Data analysis and interpretation**	**4 hours**
Tests of hypothesis, Tests of significance, Large samples(sample and population mean and proportion, comparison of 2 samples mean and proportions), student's t-test, F-test, Non-parametric test: chi-square test, Goodness of fit, Analysis of variance - determination of 95% and 99% confidence limits for an estimated value.		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Daniel WW, Cross CL (2013) Biostatistics : A Foundation Sciences
Reference Books	
1.	Forthofer RN, Lee ES, Hernandez M (2006) To Design, Analysis, and Discovery. Elsevier Ltd., Amsterdam.

Mode of evaluation: Continuous assessment and Final Assessment test.			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Course code	Course Title	L	T	P	J	C
BIT 1009	Biobusiness	3	0	0	4	4
Pre-requisite	NIL	Syllabus version				
		2.10				

Course Objectives:

1. Illustrate the basics of biobusiness in various emerging biological field
2. Build critical thinking capability and design methodologies for entrepreneur
3. Create the ability for planning, commencing, executing and managing business

Expected Course Outcome:

1. Identify basic terminology related to biobusiness correctly and contextually
2. Compare the traditional and contemporary biobusiness
3. Construct of organisational structures and procedures in industry, company and institute
4. Examine problem statement and design business plan
5. Evaluate and develop critical thinking leading to innovative skills related to business
6. Develop the protocol to approach funding agencies both government and non-government

Student Learning Outcomes (SLO):	3,15,19

Module:1	Introduction to Biobusiness	3 hours

Introduction to Biobusiness, Fundamentals of Biotech for bio-Business, Contemporary Vs antique Biobusiness, Wealth Creation in Biobusiness

Module:2	Health Science and Life Sciences in Business	4 hours

Healthcare, Biomedical sciences, Industrial Life Sciences and Biotechnology, Where Things Stand: A Quick Survey of Regional and Global Strengths and Capabilities

Module:3	Agriculture and Environment in Business	7 hours

Agriculture based business, Food Industry; Business related to Environment Management, Bioremediation, Bioleaching and waste management.

Module:4	World Class Corporation	5 hours

Creating World Class Corporations, Biotech Clusters, Process of Business commencement, Ethics in business, Reason for business failures, causes and preventive measures.

Module:5	Protecting the Intellectual Property	7 hours

Intellectual Property, Technology Licensing and Branding, Patenting, Copyright, Geographical Indicator, Trade Secretes.

Module:6	Regulatory Rules	7 hours

Opportunities for business, Policy and Regulatory Concerns, Human Resource, Financing incentives and subsidies and bounties for business units by government and NGOs.

Module:7	Entrepreneurship	7 hours

Myths of Entrepreneurship, Factors affecting entrepreneurship growth, Future of Entrepreneurship, Entrepreneurship Development Programme (EDP's) Technology Business Incubator, Open Discussion Recent updates, Group Project Presentation: Case studies of different industries and their strategic planning		
Module:8	**Contemporary issues:**	**5 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)

1.	Science Business: The Promise, the Reality, and the Future of Biotech 1st Edition by Gary P. Pisano. ISBN-13: 978-1591398400; ISBN-10: 1591398401
2.	From Alchemy To IPO: The Business of Biotechnology by Cynthia Robbins-roth ISBN-10: 073820482X; ISBN-13: 978-0738204826
3.	Building Biotechnology: Biotechnology Business, Regulations, Patents, Law, Policy andScience 4th Edition by Yali Friedman ISBN-13: 978-1934899298; ISBN-10: 193489929
4.	All in: 101 Real Life Business Lessons for Emerging Entrepreneurs Hardcover 2017, BillGreen. Publisher: Koehler Books, ISBN-10: 1633934667; ISBN-13: 978-1633934665.
5.	Bioorganic Phase in Natural food: An overview.Gnanavel Velu, Veluchamy Palanichamy, Anand Prem Rajan (2018). Phytochemical and pharmacological importance of secondary metabolites in modern medicines. Springer, 135-156. ISBN 978-3-319-74210-6

Reference Books

1.	**Tools of Titans:** The Tactics, Routines, and Habits of Billionaires, Icons, and World-Class Performers Hardcover 2016, by Timothy Ferriss, Arnold Schwarzenegger. Publisher: Houghton Mifflin Harcourt, ISBN-10: 1328683788; ISBN-13: 978-1328683786.
2.	**Disrupted:** My Misadventure in the Start-Up Bubble Hardcover 2016, Dan Lyons. Publisher: Hachette Books, ISBN-10: 0316306088; ISBN-13: 978-0316306089.
3.	**Idea to Execution:** How to Optimize, Automate, and Outsource Everything in Your Business Paperback 2016, Ari Meisel, Nick Sonnenberg. Publisher: Lioncrest Publishing, ISBN-10: 1619615053; ISBN-13: 978-1619615052.
4.	**Unshakeable:** Your Financial Freedom Playbook Hardcover 2017, Tony Robbins. Publisher: Simon & Schuster, ISBN-10: 1501164589; ISBN-13: 978-1501164583.
5.	**Grit:** The Power of Passion and Perseverance Hardcover 2016, Angela Duckworth. Publisher: Scribner; ISBN-10: 1501111108; ISBN-13: 978-1501111105.
6.	**The Third Wave:** An Entrepreneur's Vision of the Future Hardcover 2016, Steve Case.

	Publisher: Simon & Schuster, ISBN-10: 150113258X; ISBN-13: 978-1501132582.
7.	**Pivot:** The Only Move That Matters Is Your Next One Hardcover 2016, Jenny Blake. Publisher: Portfolio, ISBN-10: 1591848202; ISBN-13: 978-1591848202.
8.	**Be Obsessed or Be Average** Hardcover 2016, Grant Cardone. Publisher: Portfolio, ISBN-10: 1101981059; ISBN-13: 978-1101981054.
9.	**Big Magic: Creative Living Beyond** Fear Paperback 2016, Elizabeth Gilbert. Publisher: Riverhead Books; Reprint edition, ISBN-10: 1594634726; ISBN-13: 978-1594634727.
1.	**Journal Papers** A.S. Deshpande, R. Kumari, Anand. Prem RajanA delve into the exploration of potential bacterial extremophiles used for metal recovery Global J. Environ. Sci. Manage.,4(3): 373-386, DOI: 10.22034/gjesm.2018.03.010
2.	Anand Prem Rajan and Shamundeeswari.A (2017). Investigation of carcinogenic and mutagenic property of food color using cat fish *Clarias batrachus* by using alkaline single-cell gel electrophoresis (COMET) assay and micronucleus assay. International JournalofMedical Research and Pharmaceutical Sciences, Volume 4, Issue 7:29-34.
3.	Premsingh, and Anand Prem Rajan2017. Ecoinformatics- A revolutionary Bioinformatics. *Int. J. Res Pharm Sci 8(2) 239-246*
4.	Debolina Banerjee and Anand Prem Rajan *2017.* Consuming fish for nutrition and medicine is boon or doom: a review on scientific perspective*Int. J. Res. Ayurveda Pharm. 8 (Suppl 1)*

Mode of evaluation: Use of technology in teaching, lecture by industry ,Written Examination, Projects and assignments			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

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Course code	Course Title	L	T	P	J	C
BIT 1010	Computational Biochemistry	2	0	0	4	3
Pre-requisite	BIT 2004	Syllabus version				
		1.1				

Course Objectives:

1. To understand and apply molecular modelling and molecular mechanics to simulate or predict biochemical phenomena such as chemical structure, bonding and reactivity
2. To gain ease of use of molecular graphics software and operating systems
3. To select the correct technique for a given problem, an appreciation of the pros and cons of different computational techniques will be used.

Expected Course Outcome:

1.Relate the theory, concepts and terminology of computational biochemistry with an emphasis on organizations of biochemical components
2.Illustrate the major biotransformation reactions and the applications of computer technology in biochemistry
3.Identify of the basic mechanism of biomolecular interaction, as well as protein-protein interactions
4.Interpret the mechanism of protein-carbohydrate interactions and protein-nucleic acid interactions, as well as deriving biological function of genome information with sequence and structure analysis towards prediction of protein function
5.Develop problem solving skills and analytical thinking skills in performing molecular docking, computer simulations and conformational analysis
6.Compile the patterns and mechanisms in genome evolution with evolutionary dynamics

Student Learning Outcomes (SLO):	2,7

Module:1	Principles of biochemical system	4 hours

Organizations of biochemical components - structural, dynamic and information biochemistry, energy contribution and distance of noncovalent interactions in biomolecules

Module:2	Computing of Physical principles	4 hours

Major biotransformation reactions in biological system, applications of physical principles in computing, application of computer technology in biochemistry.

Module:3	Computation of Interactions-I	4 hours

Computational aspects - mechanism of Biomolecular Interaction- Protein-protein interactions.

Module:4	Computation of Interactions-II	4 hours

Computational aspects - mechanism of protein-carbohydrate and protein-nucleic acid interactions.

Module:5	Discovering Biomolecular Mechanisms	4 hours

Deriving Biological Function of Genome Information with sequence and structure Analysis, Prediction of Protein Function.

Module:6	**Molecular Mechanics**	**4 hours**
Force field, Geometry optimization, Computer simulations, Conformational analysis, Clues from Three-Dimensional Structure Analysis, Molecular Docking.		
Module:7	**Genome evolution**	**4 hours**
Patterns and mechanisms in genome evolution - Evolutionary dynamics- Distributions of protein folds and super families in genomes and some models of genome evolution. Evolutionary dynamics of multidomain proteins.		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Forbes J. Burkowski, Computational and Visualization Techniques for Structural Bioinformatics Using Chimera (Chapman & Hall/CRC Mathematical and Computational Biology), 2014, 1st Edition, Chapman and Hall/CRC, England
Reference Books	
1.	Jeremy M. Berg, LubertStryer, John L. Tymoczko, Gregory J. Gatto, Biochemistry, 2015, 8th Edition, WH Freeman publisher, New York
2.	Wei Zhang, Computer-Aided Drug Discovery (Methods in Pharmacology and Toxicology), 2016, 1st Edition, Humana Press, USA

Mode of evaluation: Continuous assessment and Final Assessment test.			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Course code	Course Title	L	T	P	J	C
BIT 1011	Social Entrepreneurship	2	0	0	4	3
Pre-requisite	Nil	Syllabus version				
		2.0				

Course Objectives:

1. Design operations for double bottomline- profit and social impact innovation
   Focused on local social or environmental problems Institutionalizing impact Scaling up to reach more beneficiaries or customers from the bottom of the pyramid to maximize impact.
2. Identify and develop attractive opportunities within field of experience.
3. Demonstrate scientific research in the field of entrepreneurship

Expected Course Outcome:

1. Analyze the impact of a social venture as the social entrepreneur and compare successful with unsuccessful social venture.
2. Adapt and estimate the social impacts for respective social problems identified during their project based learning mode.
3. Perceive and prioritize the requirements towards business plan proposals
4. Develop business models and classify their advantages over the existing models
5. Classify and interpret the demands needed for solving social issues
6. Compare and contrast the financial outcome on their financial plans and ROI

Student Learning Outcomes (SLO):	1,2,3

Module:1	Introduction to Social Entrepreneurship	6 hours

• What is a social enterprise • Is it a new idea. • What is causing these new kinds of companies to be forming worldwide, i.e. why are entrepreneurs creating them. What need are they filling • What kinds of businesses fall into this field. • How are they the same or different from any other companies • How are they similar and/or different than nonprofit organizations and other social service providers. • Who is creating social enterprises • Are they successful. In what terms. • What are some examples • Where is all this activity and innovation heading

Module:2	The Blurring Boundaries Between Nonprofits, Governments, Corporations and Business	4 hours

• What is the relationship of social enterprises to other companies, market • What is their relationship with traditional nonprofits and government services • What is legal structure(s) do social enterprises use. • What is the Fourth Sector

Module:3	**The Business of Change**	**4 hours**
• Would you invest your own capital in a new or expanding business • What criteria would you use to assess the risk of such an investment • Should businesses care about their impact on the community and the environment and if so, why. What if it hurts their bottom-line What is the purpose of a business • Would you care if the company you invest in causes damage to people or the planet as long as it gives you a good financial return • If part of the reward you want to earn is to improve some facet of the environment or society as well as make money how will you know if the investment is successful.		
Module:4	**Business Plan Writing**	**5 hours**
What would you look for in a business plan for any company What is useful information and what is vital for making an investment decision. Why. • Are using plans for a start-up as or more important than a plan for expansion. • What tends to fail more often: good ideas and a weak team or a great team and a weak idea		
Module:5	**Capital/Funding/:**	**3 hours**
• What is a social impact investor How do they differ from venture philanthropists and how are both different from traditional venture capital and market investors. • What kinds of investments do social impact investors make • Approximately how much money is available to invest though social impact investment pooled funds worldwide		
Module:6	**Financing**	**4 hours**
• Where do most social enterprises get financing for start-up, establishment, growth and expansion. • How do they measure ROI • Do they provide an exit strategy for investors? • What pressures are/may be impacting the investment market that may make getting funding for a socially responsible company easier than for one that is not		
Module:7	**Social Entrepreneurship and the challenges of scale**	**2 hours**
What does 'going to scale' mean? How is it done? How much 'scale' is enough? How do you know? **Challenges**: What are some key challenges for businesses trying to go to scale? For social enterprises? What are some methods for taking a social enterprise to scale? What role can major corporations, like multinationals, play in taking social enterprises to scale?		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**30 hours**

Text Book(s)

1.	"Creating Social Change: 10 Innovative Technologies," John Voelcker
2.	"How to Write a Great Business Plan," Sahlman

3.	Succeeding at Social Enterprise		
Reference Books			
1.	"Sources of Financing for New Nonprofit Ventures," Dees & Dolby.		
2.	"Impact Investing: Bold Models to Drive Development at Scale," Rockefeller Foundation.		
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

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Course code	Course Title	L	T	P	J	C
BIT 2009	Protein Engineering And Design	3	0	0	4	4
Pre-requisite	BIT 1005	Syllabus version				
		2.10				

Course Objectives:

1. To think of protein as an entity that can be engineered using molecular tools in order to achieve novel physical and chemical properties
2. To study advanced methods and strategies used in engineering the proteins
3.To execute the proteins in therapeutics and industrial perspectives

Expected Course Outcome:

1. Demonstrate advanced biophysical techniques for protein analysis, including the capacity to discuss their relative merits and interpret data from those techniques.
2. Explain rational design, purification and stability
3. Extending the techniques for modifying proteins
4. Capability to design all the steps required to produce an expression system for a new protein.
5. Able to apply protein engineering knowledge for industrial applications
6. Familiarity with software for protein visualization and modelling.

Student Learning Outcomes (SLO):	2,11,17

Module:1	Basics of Protein Biochemistry	4 hours

Covalent and noncovalent interactions between amino acids in proteins, hydration properties, protein life cycle with respect to Proteosomal pathway

Module:2	Protein stability and structural dynamics	6 hours

Forces involved in stability; protein denaturation; adaptation to extreme conditions; protein folding theories; protein folding *in vivo*; spontaneous dynamics; external factors influencing dynamics

Module:3	Techniques for the determination of 3D structures	5 hours

NMR spectroscopy, X-ray diffraction, neutron diffraction, electron diffraction

Module:4	Membrane proteins and Structure-function relationship	7 hours

Basics of biological membrane structure; principles of membrane protein structure; membrane-protein interactions; structure-function relationship in membrane proteins and peptide – case studies with respect to antimicrobial peptides and G-protein coupled receptors

Module:5	Protein Engineering Strategies	7 hours

Rational design: Site directed mutagenesis. Non-rational design: Molecular evolution; generation of combinatorial libraries; surface display. *De novo* protein design (Specific examples to be taken

for illustration)		
Module:6	**Protein Engineering for Affinity Purification and Stability**	**7 hours**
Common affinity tags; case study with streptavidin; engineering streptavidin and strep-tag peptide; applications of strep-tag. Engineering for stability: Rational approach to stabilization; case study of neutral protease and glucoamylase; stability of proteins upon mutations.		
Module:7	**Protein Engineering in Therapeutics and Diagnostics**	**7 hours**
Therapeutic antibodies – chimeric and humanized antibodies; designer antibodies and bispecific antibodies. Application in Biosensor and vaccine development. **Protein engineering in specified industrial applications**: Enzymes for leather processing, textiles and detergents, food		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Paulo Almeida, Proteins: Concepts in Biochemistry, 2016, First Edition, Garland Science Publishers, USA.
2.	Amit Kessel, NirBen-Tal (2011) Introduction to proteins – Structure, Function and Motion, CRC Press (Taylor and Francis group), UK.
Reference Books	
1.	David Whitford (2013) Proteins – Structure and Function, John Wiley and Sons Ltd., 2013
2.	Pravin Kaumaya (2012) Protein Engineering, InTech Publishers, (http://www.intechopen.com/books/protein-engineering)
3.	Stefan Lutz, Uwe T Borncheuer (2009) Protein Engineering Handbook. Ed.Wiley-VCH Verlag GmbH and Co, Germany.

Mode of evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

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Course code	Course Title	L	T	P	J	C
BIT 2010	Pharmaceutical Biotechnology	3	0	0	4	4
Pre-requisite	BIT 1005	Syllabus version				
		2.10				

Course Objectives:

1. Outline the awareness on pharmacology and biotechnology based pharmaceutical products.
2. Develop the basic skills necessary for employing biotechnology principles.
3. Evaluate the different pharmaceutical parameters of the current and future biotechnology related products on the market.

Expected Course Outcome:

1. Demonstrate the challenges in the development of new drugs
2. Evaluate the manpower to the biotechnology based pharmaceutical companies, clinical trial industries
3. Make up to aspire as consultants in KPO healthcare industry
4. Build the biotechnology applications in the pharmaceutical field
5. Create enough knowledge to take up pharmaceutical biotechnology as a research career to develop newer products
6. Illustrate the pharmacological mechanisms of pharmaceuticals and biologics

Student Learning Outcomes (SLO):	2, 11

Module:1	General pharmacology	6 hours

Introduction - Development of Drugs, Pharmacokinetics and pharmacodynamics, routes of drug administration, Bioavailability curve, Drug receptor interaction, adverse drug reaction, prescription.

Module:2	Analgesics	6 hours

Mechanism of action of local and general Anaesthetics, opioid analgesics and antagonists, NSAIDs

Module:3	Pharmacology	6 hours

antihistamines, pharmacotherapy of hypertension, electrolytes, diuretics, pharmacotherapy of peptic ulcer

Module:4	Biotechnology based drugs	6 hours

Pharmacokinetics and pharmacodynamics of peptide and protein drugs. Routes of drug administration of conventional and biotechnology drugs-comparisons.

Module:5	Formulating biotech drugs	6 hours

Microbial decontamination, excipients used in biotech products, self-life of protein based drugs, absorption enhancement in protein drugs, controlled and site specific delivery of protein drugs

Module:6	Pharmacotherapy of Protein drugs	6 hours

Pharmacotherapy using Cytokines, interleukins and interferon-Gama, insulin and insulin

analogues in diabetes treatment. Growth hormone			
Module:7	**Antibody therapeutics**		**7 hours**
Modern vaccines -subunit vaccines, r-DNA vaccines, Development of antibody based drug therapy, monoclonal antibody, murine antibody, chimeric antibody, humanized antibody. Drug regulations: FDA regulations (General) and Indian Drug regulations- highlight. Adulterated, Spurious, and Misbranded drugs. Clinical trials: Classification, Phases of clinical trials. Clinical Trials & Regulations - Clinical Trials – Design, double blind studies, placebo effects, Informed consent.			
Module:8	**Contemporary issues:**		**2 hours**
Lecture by Industrial Expert			
	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	Laurence Brunton (Author), Bruce Chabner (Author), Bjorn Knollman (Author). 2014. Goodman and Gilman's The Pharmacological Basis of Therapeutics, Twelfth Edition, McGraw-Hill Education
Reference Books	
1.	R. S. Satoskar (Author), S. D. Bhandarkar (Author), Nirmala N. Rege (Author), 2014. Pharmacology and pharmacotherapeutics, 22nd Edition, Popular Prakashan P. Ltd.- New Delhi.

Mode of evaluation: CAT / Assignment / Quiz / FAT / Seminar			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Course code	Course Title	L	T	P	J	C
BIT 2011	Developmental Biology and Regenerative Medicine	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		2.10				

Course Objectives:

1. To provide a glimpse of scope and historical background of developmental biology to the students.
2. Knowledge regarding basic concepts of differentiation and growth, differential gene expression as well as cytoplasmic determinants to the students.
3.To develop detailed understanding of essential events of developmental biology through proper explanation of gametogenesis, fertilization, blastula formation, gastrulation as well as embryological induction as part of early embryonic development

Expected Course Outcome:

At the end of the course, student should be able to:

1. Explain an overview developmental biology and its approaches
2. Summarize the process of gametogenesis and fertilizations
3. Paraphrase the developmental process and concepts of polarity in invertebrates
4. Discuss the embryonic development of vertebrates including humans
5. Identify the factors associated with segmentation and sex determination in animal embryos
6. Restate various post-embryonic developmental processes, able to discuss aspects of regenerative medicine and able to describe real world applications of developmental biology

Student Learning Outcomes (SLO):	2

Module:1	Introduction	5 hours

Overview of Developmental Biology. Mathematical Modelling of Development growth (The mathematics of organismal growth / The mathematics of patterning). Approaches to Developmental Biology. Model organisms

Module:2	Gametogenesis and Fertilization	6 hours

Formation and Structure of the Gametes, Types of sperm, Recognition of Egg and Sperm, Gamete Fusion and the Prevention of Polyspermy (Acrosomal process) in Sea urchin and Humans.

Module:3	Drosophila	5 hours

Early Drosophila Development .The Origins of Anterior-Posterior Polarity. The Generation of Dorsal-Ventral Polarity

Module:4	Amphibians	6 hours

Early Amphibian (frog) Development (germ layers), Axis Formation in Amphibians. Cytoplasmic determinants in amphibians. Compare and contrast zebra fish and amphibian axis specification and gastrulation.

Module:5	**Vertebrates - Birds and mammals**	**6 hours**
Early Development, and Axis Specification in Birds (chick) and Mammal (Mouse). Role of Cerberus in chick head formation. Tetrapod limb development (role of FGF).Neurulation (Neural Tube Formation)		
Module:6	**Sex determination and Homeotic Genes**	**6 hours**
Chromosomal Sex Determination in Mammals, Primary and secondary sex characteristics Chromosomal Sex Determination in Drosophila, Environmental Sex Determination.		
Module:7	**Metamorphosis, Regeneration, and Aging**	**9 hours**
Metamorphosis: The Hormonal Reactivation of Development (Insect metamorphosis). Regeneration (Salamander Limbs/ Mammalian Liver/ Bone regeneration). **Stem Cells**: stem cell, Regenerative Therapy –Introduction, Large scale manufacturing of cells, tissues and organs **Applied Regenerative Medicine**: Applications of Regenerative Medicine in the nervous system, eye, heart, lung, liver, kidney, pancreas and kidney.		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)

1. Gilbert (2013) Developmental Biology, 10th Edition.
2. Slack JMW (2012) Essential Developmental Biology. 3rd Edition, Blackwell publishing.
3. Hossein Baharvand, Nasser Aghdami (2013) Regenerative Medicine and Cell Therapy (Stem Cell Biology and Regenerative Medicine). Humana Press.
4. David L Stocum (2012) Regenerative Biology and Medicine, 2nd Edition, Academic Press.

Reference Books

1. Bruce M Carlson (2011) Human Embryology & Developmental Biology, 4th Edition.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Course code	Course Title	L	T	P	J	C
BIT2012	Metabolic Engineering	3	0	0	0	3
Pre-requisite	BIT1005	Syllabus version				
		1.1				

Course Objectives:

1. To provide a basic knowledge about strategic manipulation of metabolism
2. To provide quantitative perspective of metabolic regulations and developing metabolic models
3. To demonstrate metabolic network construction and reconstruction

Expected Course Outcome:

1. Apply knowledge of mathematics, science, and engineering
2. Integrate modern biology with engineering principles
3. Analyze flux to identify nodal control
4. Model enzyme kinetics and metabolic fluxes along with control
5. Identify, formulate, and solve biochemical engineering problems
6. Design metabolic models to represent metabolic networks in single cells and at the organ level

Student Learning Outcomes (SLO):	1,17,18

Module:1	Basics of metabolic engineering	6 hours

Cellular metabolism; order and molecularity of the reactions; concepts of chemical equilibrium; stoichiometry of cellular reactions; reaction rates, dynamic mass balances, yield coefficients and linear rate equations

Module:2	Metabolic pathway analysis and regulation	8 hours

Metabolic pathways databases, Modelling and measurement of synthetic accessibility; Overview of enzyme activity and concentration; global control regulation; Limiting accumulation of end-products, regulation of metabolic networks, Alteration of feedback regulation

Module:3	Basics of metabolic flux analysis	7 hours

Concept of Nodal points, Linear and Branched pathways, Determined, overdetermined and undetermined systems; sensitivity analysis, OPTflux Software for MFA

Module:4	Methods for metabolic flux analysis	6 hours

Direct flux determination, enumeration of metabolite isotopomers (NMR and MS), carbon metabolite balances, applications of metabolic flux analysis with respect to E.coli / yeast

Module:5	Fundamentals of metabolic control analysis	6 hours

Identification of independent pathways, Flux control coefficients; MCA analysis of metabolic networks

Module:6	Methods for metabolic control analysis and metabolic design	5 hours

Determination of flux control coefficients, concentration control coefficients, application of

MCA. Randomized and targeted strain development strategies with specific examples/case studies, Recent developments in Metabolic design			
Module:7	**Metabolic engineering in practice**		**5 hours**
Synthetic Biology, Design of genetic circuits, Amino acid production by glutamic acid bacteria, flux analysis of deletion mutants in *C. glutamicum*, producers and applications for secondary metabolites, Metabolic engineering application in Biopharmaceuticals, Bioremediation, Biofuels and Agriculture and food			
Module:8	**Contemporary issues:**		**2 hours**
Lecture by Industrial Expert			
	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	George Stephanopoulos, Aristos A Aristidou, Jens Nielsen (2005) Metabolic Engineering - Principles and Methodologies. Academic Press Inc.
Reference Books	
1.	S. Sen, L. Datta and S. Mitra (2018) Machine Learning and IoT: A Biological Perspective, CRC Press, Taylor and Francis Group
2.	Michael E Wall, (2012) Quantitative Biology: From Molecular to Cellular Systems, Chapman & Hall.
3.	Arul Jayaraman, Juergen Hahn (2009) Methods in Bioengineering: Systems Analysis of Biological Networks, Artech House Publishers.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Course code	Course Title	L	T	P	J	C
BIT 2013	Industrial Enzymology	3	0	0	0	3
Pre-requisite	BIT1005	Syllabus version				
		2.10				

Course Objectives:

1. Learning basic principles of enzyme and its structure, function and kinetics, mechanism of enzyme action and inhibitors
2. Understanding the application of enzymes for various industrial processes.
3. Dealing with the contemporary issues and adapting to future application of enzymes in industries

Expected Course Outcome:

1. Compare and contrast the historical uses of enzyme technology with current applications in a diverse range of industries.
2. Understand the kinetics of enzyme catalyzed reactions and enzyme regulatory process
3. Discover new applications of enzymes. Design new processes with the use of enzymes.
4. Acquire knowledge in screening and purification of enzymes.
5. Understand the principles of enzyme modification to improve stability and industrial catalysis
6. Impart the skills in Enzyme Kinetics, Immunological Techniques and Biostatistics

Student Learning Outcomes (SLO): 1,2,6

Module:1	Introduction to enzymology	4 hours

History of Industrial enzyme development. Enzyme types, sources and classification, Enzyme activity and kinetics – determination of physical factors affecting optimal activity and stability of enzymes

Module:2	Brewing and Baking industry	6 hours

Processes involved in beer and wine production –use of endogenous and exogenous enzymes – enzymes used in production process and to enhance shelf life; Use of Enzymes in industrial dough making process

Module:3	Dairy Industry	5 hours

Process involved in cheese manufacture, enzymes in cheese manufacture, ripening, flavor and quality, Enzyme modified cheese (ENC); processing of whey.

Module:4	Fruit, Vegetable and meat processing	6 hours

Process involved in fruit juice production – cell wall degrading enzymes in the production of citrus and non-citrus fruit juices; Enzymes in meat processing industry

Module:5	Paper, Textile and leather	7 hours

Process and production of pulp for paper, applications of enzymes for paper and pulp; Process of preparing desizing liquors in textile industry). Leather processing steps and enzyme application – curing, soaking, dehairing, dewooling, bating, tanning.

Module:6	**Enzymes in Medicine**	**8 hours**
Diagnosis and prognosis of disease (LDH, creatine kinase, Alkaline phosphatase), Therapeutic enzymes- Case studies: Hyaluronidase, streptokinase, Uricase, glucocerbrosidase, adenosaminenase and others, Enzymes in pharmaceutical industries.		
Module:7	**Altering enzyme performance and stability**	**7 hours**
Modification of industrial enzyme function and stability by enzyme engineering approaches; immobilization of enzymes. Safety and regulatory aspects: ethics in the use of enzymes in food products, medical and dietary considerations, evaluation of enzyme safety, toxicity consideration in the use of enzymes		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Enzymes Biotechnology N Gray, M Calvin, SC Bhatia CBS Publishers and Distributors Pvt Limited Edition 2010
Reference Books	
1. 2. 3	Industrial Enzymology- Ed Godfrey and West, Macmillan Press Ltd 2nd edition 1996 Fundamentals of Enzymology - Lewis Stevens, Nicholas C. Price, Oxford University Press 3rd Edition 1999 Recent review articles in peer review journals
	Authors, book title, year of publication, edition number, press, place
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Course code	Course Title	L	T	P	J	C
BIT2014	Proteomics	3	0	0	0	3
Pre-requisite	BIT2006	Syllabus version				
		2.0				

Course Objectives:

1. Enhancing the basic understanding of the emerging technologies related to the analysis of genomes and proteomes
2. Imparting experimental design thinking capability in relation to using appropriate analytical methodologies for the qualitative and quantitative proteomics
3. Extrapolating the design thinking skills to real time scenarios, with special reference to human diseases

Expected Course Outcome:

1. Differentiate genomic and proteomic approaches
2. Design suitable chromatographic and electrophoretic methodologies for the analysis of a given proteome
3. Distinguish the utility of different analytical techniques that can be used to delineate the structural features of proteins
4. Device methodologies for qualitative and qualitative analysis of the proteome with respect to post-translational modification and molecular recognition events involving proteins
5. Apply proteomic approaches to analyse the disease conditions
6. Infer the basic concepts of genomics, transcriptomics and proteomics

Student Learning Outcomes (SLO):	2,5,18

Module:1	Introduction and overview of proteomics	5 hours

Overview of protein chemistry, Proteomics and its application, Functional proteomics in post-genomic era, Proteomics experimental workflows, Gene-Protein families link with examples, Human proteome draft

Module:2	Application of Chromatography in proteomics	6 hours

Application of separation techniques in proteomics - Multidimensional chromatography, use of nanoLC, COFRADIC combined fractional diagonal chromatography, HILIC-hydrophilic interaction liquid chromatography, SAX- strong anion exchange chromatography, SCX- strong cation-exchange chromatography, affinity chromatography, reverse phase and normal phase

Module:3	Abundance based Proteomics	7 hours

Gel based proteomics. Variations in 2-D gel electrophoresis, Difference Gel Electrophoresis (DIGE), and Mass spectrometry based proteomics- Analysis of data, MALDI, SELDI, Peptide mass fingerprinting, Protein microarray (analytical, functional, reverse phase), protein sequencing

Module:4	Structural Proteomics	6 hours

Application of X-ray crystallography, Circular Dichroism, Nuclear Magnetic Resonance, Plasmon Resonance, Small Angle X-ray Scattering

Module:5	**Post-translational modification and Tagging of Proteins**	**6 hours**
Analysis of posttranslational modifications, Phosphorylation, ubiquitination (poly and mono), acetylation, nitration, glycosylation, Sumoylation, disulphide bond formation, signal peptide cleavages. Tagging of proteins with chemical and genetic approaches		
Module:6	**Targetted Proteomics – Macromolecular Interactions**	**7 hours**
Qualitative and quantitative proteome analysis, Short-gun proteomics for proteome profile (whole proteome and sub-proteome analysis), Expression proteome analysis (isotope-labeling and label-free approaches), Proteomic analysis of protein-protein (including antigen-antibody interactions for epitope mapping), protein-DNA interactions, Identification of ligand receptor pairing and transcriptional regulators.		
Module:7	**Proteomics in Clinical and Drug Discovery Applications**	**6 hours**
Proteomics in study of diseases, Storage transportation and processing of clinical samples, Proteomic analysis of body fluids, Western Blotting, systems biology approaches and interaction network for drug discovery		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)

1.	Twyman RM (2013) Principles of Proteomics, Taylor and Francis, Garland Science

Reference Books

1.	Westermeier R Naven T (2008) Proteomics in Practice: A Guide to Successful Experimental Design, Wiley-VCH
2.	Link AJ, LaBaer J (2009) Proteomics: A Cold Spring Harbor Laboratory Course Manual, Cold Spring Harbor Laboratory Press
3.	Hubert R (2006) Protein Biochemistry and Proteomics (The Experimenter Series), Academic Press
4.	Proteomics: Methods and Protocols (2017), Methods in Molecular Biology Series, Ed. Lucio Comai · Jonathan E. Katz Parag Mallick, Humana Press. USA.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

VIT®
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Course code	Course Title	L	T	P	J	C
BIT 2015	Stem Cell Technology	3	0	2	0	4
Pre-requisite	BIT 1006	Syllabus version				
		2.10				

Course Objectives:

1. Recall and relate the fundamental concepts, basic terminologies, and widely used methods related to the field of stem cell biology
2. Illustrate the role of various epigenetic modifications and cell signaling pathways in the determination of stem cell fates
3. Compare and dissect different mechanisms and methods involved in cutting-edge stem cell technologies

Expected Course Outcome:

1. Explain the importance of the existence of stem cells in every tissue/organ, and their immense potential in tissue/organ regeneration
2. Compare the levels of potency that exists between different types of stem cells, and identify their commitment toward restricted lineages
3. Identify the roles of various epigenetic modifications in the determination of stem cell fates in both normal and disease conditions
4. Examine the roles of cell signaling pathways in early embryonic development, as well as in adult health and disease (dysregulation) states
5. Demonstrate the importance of the role of stem cell niches in the maintenance of tissue/organ homeostasis, and how an imbalance could lead to cancer
6. Discuss the potential of induced pluripotent stem cells in disease modeling of tissues/organs and in future regenerative therapies and outline challenges in contemporary stem cell-related issues.

Student Learning Outcomes (SLO):	2,4,5,10,11,12,18	
Module:1	**Introduction to Stem Cells**	**5 hours**

History (anecdotal and folk-lore-based), Fundamental concepts, Terminologies, Models, Politics and Ethics, Classification of stem cells, role of the niche, microenvironment.

Module:2	**Signal Transduction Pathways, Molecular Regulation and Methods**	**8 hours**

An integrated perspective of signaling of pathways, mechanotransduction. Molecular regulation - Common themes ; molecular determinants of pluripotency, cell cycle regulation. Methods – Detection, Production, functional characterization of stem cells (Overview). Reprogramming, iPSCs and transdifferentiation (general concepts).

Module:3	**ESCs, PGC, epiblast stem cells and Stem Cell epigenetics**	**7 hours**

Differences between ESCs, PGCs and epiblast stem cells. Role of epigenetic factors regulating stem cell fate. Epigenetic Memory and Epigenetic states; Real time Imaging.

Module:4	**Keratinocyte (basal stem cells, the hair follicle**	**6 hours**

	stem cells) and Neural Stem Cells– Localization & Fate	
Proliferation and differentiation/targeted differentiation methods. Role of the niche. Latest molecular methods and techniques.		
Module:5	**HSCs - Classical reconstitution experiments**	**5 hours**
Proliferation/targeted differentiation. Molecular Regulation, Role of the HSC niche. Latest molecular methods and techniques.		
Module:6	**Mesenchymal Stem Cells and dental pulp stem cells. MSCs – Localization and Fate**	**6 hours**
Proliferation and targeted differentiation; immunomodulatory role of MSCs. Latest molecular methods and techniques.		
Module:7	**Muscle Satellite, Non-satellite and Intestinal Stem Cells – Localization and fate**	**6 hours**
Proliferation and differentiation/targeted differentiation. Role of the niche. Latest molecular methods and techniques. Applications of stem cell technology -Disease Modeling – 2D and 3D methods – neurological vs non-neurological disorders. Overview and limitations of cell therapy		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Experts		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Harvard Stem Book – www.stembook.org
Reference Books	
1 2.. 3 4. 5.	Yanhong S., Dennis C.O. (Ed.) Stem Cell Research & Therapeutics. Springer. New Delhi. 2010. Lanza R., Gearhart J., Hogan B., Melton D. , Pedersen R., Thomas D.E., Thompson J., Wilmut I. Essentials of Stem Cell Biology, 2nd ed., Elsevier, Inc. 2009. Bosch Thomas C.G. Stem Cells: From Hydra to Man. Springer. 2008. Discussion of relevant peer-reviewed articles and special issues on the subject Newton D.E.Stem Cell Research. Viva Books Pvt. Ltd.Delhi. 2008.
	Authors, book title, year of publication, edition number, press, place
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

List of Challenging Experiments (Indicative)		
1.	Aseptic Technique – Dos and Donts & Documentation/Data Recording Procedure	2 hours
2.	Preparation of Mammalian and Stem cell culture Media	2 hours
3.	Growth Curve & Viability Studies –V79 cells	4 hours
4.	Subculturing Technique -V79cells	2 hours

5.	Growth Curve & Viability Studies –V79 cells	1 hour
6.	Subculturing Technique -V79cells	2 hours
7.	Cryopreservation Technique –V79 cells	1 hour
8.	Proliferation of Cryopreserved Umbilical Tissue-Derived Mesenchymal Stem Cells	1 hour
9.	Subculturing Technique-MSCs	1 hour
10	Adherence/detachment (plastic and glass cover slips) and alkaline phosphatase activity	1 hour
11	Cytological Identification of the cells-MSCs (cover slips and colony formation assay)	1 hour
12	Molecular Identification of cells (RT-PCR experiment-Oct ¾, Nanog) MSC	2 hours
13	IC_{50}-based differential cytotoxicity of immortal cells and umbilical tissue-derived Wharton Jelly Mesenchymal Stem Cells (MTT assay)	2 hours
14	Isolation of Exosomes from Culture Media (immortal cells vs stem cells)-(Conditioned versus non-conditioned)	2 hours
15	*In silico* basis for differential gene expression – stem cells vs cancer stem cells vs immortal cells	6 hours
	Total Laboratory Hours	**30 hours**

Mode of evaluation:			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

VIT®
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Course code	Course Title	L	T	P	J	C
BIT 2016	Cancer Biology and Informatics	3	0	0	0	3
Pre-requisite	BIT 2006	Syllabus version				
		2.10				

Course Objectives:

1. To understand the cellular and molecular mechanisms that are dysregulated in cancerous cells.
2. To understand the genomic technologies and develop critical thinking skills in cancer research.
3. To learn both the traditional chemotherapy and novel targeted therapeutic approaches.

Expected Course Outcome:

1. Demonstrate understanding of the subject related concepts and of contemporary issues.
2.Identify, design and conduct experiments, as well as to analyze and interpret data
3.Apply critical thinking and innovative skills
4.Interpret Sense-Making Skills of creating unique insights in what is being seen or observed (Higher level thinking skills which cannot be codified)
5.Make use of techniques, skills and modern engineering tools necessary for clinical practice
6. Apply mathematics and science in engineering applications.

Student Learning Outcomes (SLO):	2,4,7

Module:1	Overview of the hallmarks of cancer	6 hours

Hanahan and Weinberg defined six biological hallmarks of cancer, Mutagens, carcinogens – Causes for onset of genetic abnormalities, Evidence of mutation related cancers, Cellular processes that go awry in the transformation of normal cells to cancerous cells, Viruses (as causative agents).

Module:2	Oncogene activation; Tumour suppressor inactivation and Cell cycle Dysregulation	7 hours

Oncogene (activation) and signalling in cancer, Tumour suppressors (inactivation); Oncolytic mechanism, Familial cancer syndromes, Cell cycle regulation – Role of growth factors and receptors in cancer development and progression; Cyclins and cyclin-dependent kinases; Role of suppressor – Rb and p53 in cell cycle; Cell Cycle Checkpoints.

Module:3	Evading Apoptosis and Telomere dysregulation	5 hours

Apoptotic pathways and alterations in cancer, Bcl-2 Protein Family; IAPs; Endogenous inhibitors of IAPs, Telomeres, Hayflick limit, Telomerase Activation and Immortality, Alternative Lengthening of Telomere (ALT) pathway in Cancer.

Module:4	Angiogenesis and Metastasis	5 hours

Angiogenesis – Angiogenesis, mechanism and role in tumour; Metastasis – Over view of metastasis – Seed and soil theory and beyond; epithelial to mesenchymal transition, signalling pathways in metastasis.

Module:5	**Emerging Cancer Hallmarks**	**6 hours**
Emerging Hallmarks – Overview - Genomic Instability, Inflammation; Evading Immune system; Aberrant cellular energetics, Epigenetics, The Warburg effect, Introduction to Genomic Instability -Chromosomal instability (CIN), Microsatellite Instability (MSI), DNA repair dysregulation and genomic instability in Cancer, Introduction to Epigenetics -DNA methylation, Histone Covalent Modifications and their interplay in Normal and cancer Cells, An epigenetic role of RNA in cancer.		
Module:6	**Cancer stem cells**	**6 hours**
The stem cell theory of Cancer/ Somatic Evolution of the cancer stem cell model, Evidence of cancer stem cells (CSCs), Origin of cancer stem cells, markers of cancer stem cells, Metabolic landscape of cancer stem cells/signalling pathways.		
Module:7	**Cancer Diagnosis**	**8 hours**
Conventional and New Imaging Techniques; Molecular Screening and Detection: Gene and Protein Expression Profiling; Circulating CSCs diagnostics and High throughput sequence technologies to detect genetic alterations in cancer. Cancer therapeutics- Chemotherapy, Immunotherapy, Targeted Therapy, Hormone Therapy, Stem Cell Transplant, Precision Medicine. Cancer cell lines, Xenograft mode, knockout mouse model, carcinogens treated models for cancer drug discovery.		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	The Biology of Cancer – Robert Weinberg. Edition – 2nd ISBN:9780815342205 - 2013
Reference Books	
1.	Textbook readings; primary literature; in-class discussion. The Molecular Biology of Cancer: A Bridge from Bench to Bedside. Stella Pelengaris, Mike Khan -2nd Edition - 2013

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Course code	Course Title	L	T	P	J	C
BIT 2018	Food Biotechnology	3	0	0	0	3
Pre-requisite	BIT 1007	Syllabus version				
		3.0				

Course Objectives:

1. To familiarize the students with dimensions of food biotechnology.
2. To offer basics of Biotechnological Principles applied to Food Production
3. To offer Biotechnology approach to involved in processing of food.

Expected Course Outcome:

1. Apply the concepts of Biotechnology to the science of food.
2. Appraise the basics of food sciences.
3. Demonstrate the role of biotechnology in primary food produce.
4. Combine the knowledge about biotechnology with the production of food.
5. Interpret the principles of biotechnology applied to process food.
6. Demonstrate the basics of microbial products used as additives in food.

Student Learning Outcomes (SLO):	2, 9,17

Module:1	World Food Resources	5 hours

Food resources (plant, animal, microbes); Overview of current production systems; constraints and necessity of novel strategies.

Module:2	Biotechnology of food production	7 hours

Improvement of plant nutritional and functional quality (starch, protein, fatty acid modification, biofortification); functional foods; genomic analysis of food nutrients in plant produce.

Module:3	Animal food biotechnology	6 hours

Improved milk, egg and meat quality using biotechnological interventions; application of transgenic fish technology in sea food production.

Module:4	Microbes as food resource	4 hours

Concept of SCP, mushrooms, food yeasts, algal protein.

Module:5	Food fermentations	8 hours

Key concepts in fermentation; Overview of diverse fermented foods; Production process of selected fermented foods (Soyasauce, Sauerkraut, Beer, Wine, Yogurt, Cheese, Sausages); Starter cultures in food industry.

Module:6	Biotechnology of food additives	5 hours

Bioflavors and colors**,** microbial polysaccharides**,** recombinant enzymes in food sector.

Module:7	Molecular diagnostics in food quality control	8 hours

Allergens, pathogenic microbes, adulterants (natural and man-made), mis-labeled produce, GM ingredients in food products. **Food industry wastes**: Characteristics of food wastes; treatment methods; recovery of value added products. **Consumers and GM foods**: Global perspective of consumers on GM foods; Major concerns of transgenic foods (labeling, bioavailability, safety aspects); regulatory agencies involved in GM foods.			
Module:8	**Contemporary issues:**		**2 hours**
Lecture by Industrial Expert			
	Total Lecture hours:	**45hours**	

Text Book(s)	
1.	Kalidas Shetty, Gopinadhan Paliyath, Anthony Pometto, Robert E. Levin. 2015. Food Biotechnology. CRC Press. Second edition.
Reference Books	
1.	Parmjit S. Panesar, Satwinder S. Marwaha.2013**.** Biotechnology in Agriculture and Food Processing: Opportunities and Challenges. CRC press.
2.	Bertheau, Yves Davison, John. 2012. Genetically Modified and non-Genetically Modified Food Supply Chain: Co-Existence and Traceability. Wiley-Blackwell
3.	Y. H. Hui, E. Özgül Evranuz. (Eds.) 2012**.** Handbook of Fermented Food and Beverage Technology, CRC Press
4.	Ulf Stahl, Ute E.B. Donalies , Elke Nevoigt .(Volume Editors).2008. Food Biotechnology. In : Advances in biochemical engineering/biotechnology
5.	Byong H. Lee. 2014. Fundamentals of Food Biotechnology, 2nd Edition**.** Wiley-Blackwell. 544 pages. ISBN: 978-1-118-38491-6.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Course code	Course Title	L	T	P	J	C
BIT2019	Environmental Biotechnology	2	0	0	4	3
Pre-requisite	NIL	Syllabus version				
		1.1				

Course Objectives:

1. Analyse environmental pollution and to develop suitable technologies to solve the problems
2. Understand the basics for microbial metabolism of environmental contaminants
3. Apply scientific concepts to environmental problems and their correlation with technological concepts

Expected Course Outcome:

1. Apply biological treatment processes to treat solid waste
2. Appraise the microbial potential for degradation of organic pollutants
3. Outline the types of bioremediation involved in wastewater treatment
4. Evaluate the microbial processes and growth requirements involved in activated sludge process, nitrification, denitrification, enhanced phosphorus removal and anaerobic digestion
5. Discover the role of microorganisms in processes such as biopulping and biomining and also in producing bioproducts
6. Explain how plant biomass can be converted to fermentable substrates and subsequently transformed into biofuels

Student Learning Outcomes (SLO):	2,9, 18

Module:1	Solid Waste Management	2 hours

Solid waste –types, characterization, treatment and disposal technology. Landfills and composting.

Module:2	Biotechnology and Biodegradation	4 hours

Biodegradation of Herbicides and Pesticides, Hydrocarbon. Biodegradation of marine pollutants-Testing for biodegradability.

Module:3	Bioremediation	4 hours

Introduction-Types of Bioremediation-Phytoremediation, Genetically Engineered Microbes (GEM'S) in treatment of waste-Biosafety.

Module:4	Waste Water Treatment and Disposal	5 hours

Liquid phase bioremediation-Aerated process – Activated sludge process (suspended growth) Aerated lagoons Tricking filters (Attached growth)-Rotating biological contactors. Anaerobic process-Removal of nitrogen and phosphorous- Biosensors in environmental analysis.

Module:5	Emerging technique in specific pollution problems and biomining	5 hours

Biopulping -Treatment of leather and tannery wastewater- mining and metal biotechnology-microbial transformation -extraction and future aspects.

Module:6	Bioenergy	4 hours

Bio mass resources for fuel generation-Biogas and Bio diesel as energy source. Alcohol as Fuel-Biological Hydrogen Generation.		
Module:7	**Eco friendly Bioproducts for Environmental Health**	**4 hours**
Biopesticides –Biofertilizers -Bioplastics-Recent advances in environmental Biotechnology-pollution monitoring and recent developments.		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Jördening, H.J. and Winter, J. eds., 2005. Environmental biotechnology: concepts and applications. John Wiley & Sons.
2.	Das, S. ed., 2014. Microbial biodegradation and bioremediation. Elsevier.
Reference Books	
1.	Evans, G.M. and Furlong, J.C., 2003. Environmental biotechnology: theory and application. IK International Pvt Ltd.
2.	Rittmann, B.E. and McCarty, P.L., 2012. Environmental biotechnology: principles and applications. Tata McGraw-Hill Education.
3.	Rehm, H.J. and Reed, C., 1987. Biotechnology: a comprehensive treatise. Vol. 7a.
4.	Chatterjee, A.K. 2015. Introduction to Environmental Biotechnology. Prentice-Hall of India.
5.	Rajendran and Gunasekaran, P. 2014. Bioremediation. MJP Publishers.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Course code	Course Title	L	T	P	J	C
BIT 2021	Mass and Heat Transfer Operations	2	1	0	0	3
Pre-requisite	BIT1008	Syllabus version				
		2.1				

Course Objectives:

1. To realize different modes of heat transfer and mass transfer their applications in bioprocesses.
2. To enable students to design effective/ efficient bioprocesses involving heat and mass transfer.
3. To impart necessary skills to enable students to comprehend and troubleshoot challenges related to heat and mass transfer in bioprocesses.

Expected Course Outcome:

The students will be able to:

1. Describe various processing technologies that are instrumental in designing innovative improvements based on industrial needs.
2. Solve problems on situations involving heat and mass transfer operations by applying acquired facts and techniques.
3. Design and develop methodologies to analyse and interpret data pertaining to heat and mass transfer.
4. Test theoretical concepts by planning and demonstrating experiments and to propose their application in bio-industry.
5. Identify, formulate and solve engineering problems associated with heat and mass transfer in small-scale and large-scale bioprocesses.
6. Distinguish between the available process operations and propose or justify their application for meeting particular industrial needs.

Student Learning Outcomes (SLO):	1,2,6

Module:1	Basics of heat transfer	7 hours

Introduction to Heat Transfer (Heat flux, Specific heat, Film coefficient, thermal conductivity), Various modes of heat transfer (conduction, convection and radiation), Heat transfer through composite wall (rectangular, cylindrical and spherical), classification, performance and application of various types of heat exchanger in bioprocesses (food industry, ethanol production, cryogenic processes, beverage industry), Different methods of heat exchange, Estimation of heat exchange area

Module:2	Fundamental concepts of mass transfer	7 hours

Molecular diffusion; Diffusion theory; Diffusion in Bioprocessing; Film theory; Convective mass transfer; Gas-liquid, liquid-liquid, solid-fluid and gas-gas mass transfer

Module:3	Mass and heat transfer in evaporation, humidification and dehumidification	4 hours

Introduction, Concepts and bio-industrial applications of mass and heat transfer involved in evaporation, humidification and dehumidification

Module:4	Distillation and solvent extraction	5 hours

Mc-Cabe – Thiele Method, Pomchon – Savarit Method, Minimum number of Theoretical stages, Ternary equilibrium diagrams, Principles of mass and heat transfer in distillation		
Module:5	**Gas absorption**	**6 hours**
Principles of gas absorption; Absorption with Chemical Reaction; selection of solvent, design of absorption tower		
Module:6	**Applications of gas-liquid and liquid-liquid operation (Oxygen transfer from bubble to broth, Extraction of antibiotics)**	**6 hours**
Single and Multi- component concurrent, counter current and cross current operation (absorption and solvent extraction)		
Module:7	**Solid fluid operations**	**8 hours**
Types of adsorption; Nature of adsorbents; Adsorption equilibria/isotherms – Batch and fixed bed adsorption; Leaching. Heat and mass transfer in microfluids/nanofluids: Concepts of heat and mass transfer applied to microscale and nanoscale operations, applications in therapeutics (hyperthermia).		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by industrial expert.		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Treybal RE (2012) Mass Transfer Operations, 3rd Edition, McGraw-Hill.
2.	Pauline M Doran (2013) Bioprocess Engineering Principles. 2nd Edition. Academic Press.
Reference Books	
1	Warren McCabe, Julian Smith, Peter Harriott (2005) Unit Operations of Chemical Engineering, McGraw Hill Chemical Engineering Series 7th Edition.
2	Alan S. Foust, Leonard A. Wenzel, Curtis W. Clump, Louis Maus, L. Bryce Andersen (2008) Principles Of Unit Operations, 2Nd Ed, John Wiley & Sons
3	Theodore L Bergman, Adrienne S Lavine, Frank P Incropera, David P DeWitt (2011) Fundamentals of Heat and Mass Transfer, 7th Edition, Willey.
	Authors, book title, year of publication, edition number, press, place

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Course code	Course Title	L	T	P	J	C
BIT 3004	Nanobiotechnology	3	0	0	4	4
Pre-requisite	BIT 2005	Syllabus version				
		2.10				

Course Objectives:

1. Assess the various subject related concepts and of contemporary issues
2. Design and conduct experiments, as well as to analyze and interpret data
3. They should have critical thinking and innovative skills

Expected Course Outcome:

At the end of the course, student will be able to:

1. Analyze the interfacial areas of Biotechnology and nanotechnology.
2. Assess and design applications based on nanoparticle-biological system interaction
3. Examine the relationships between synthesis, characterization and properties of nanostructures with an emphasis on biological system.
4. Discuss the biosafety aspects of the nanomaterials used in various applications.
5. Develop nanomaterials based approaches for imaging and sensors
6. Formulate and assess materials for nanomedicine applications

Student Learning Outcomes (SLO):	5,9,14

Module:1	The science of nano-bio interface	5 hours

History and development of nanobiotechnology; Structure-property relationships.

Module:2	Types of biologically relevant nanomaterials	7 hours

Self-assembly as in proteins, lipids and nucleic acids; Polymeric nanoparticles; Inorganic nanoparticles- quantum dots, silica based nanostructures; metallic nanoparticles like silver and gold; nanotubes, nanowires and nanofibers.

Module:3	Synthesis and production	7 hours

Physical, chemical and Biological means of synthesis; Biomimetic approaches of production: case studies- ferritins, silica in diatoms, FeNPs in magnetosomes; Merits and demerits of bio-based approaches.

Module:4	Characterization of nanomaterial	7 hours

Optical techniques like UV-Vis and fluorescence spectroscopy; FTIR spectroscopy; electron microscopy (TEM and SEM); Atomic Force Microscopy, dynamic light scattering, zeta potential measurement, XRD (with emphasis on how these techniques aid in characterizing nanoparticles).

Module:5	Functional nanomaterials for biological applications	5 hours

Strategies for chemical and biological functionalization; Applications in tissue engineering, and regenerative medicine.

Module:6	Nanoparticles in biological labeling and	6 hours

	cellular imaging		
Nanoparticles as reporter: metallic nanoparticles and quantum dots in rapid diagnostics tools; FRET and Molecular Beacons; SPR and SERS based imaging.			
Module:7	**Potential risks of nanomaterials**		**8 hours**
Routes of exposure; Fate of nanoparticles- short and long term; Cellular interaction; environmental safety; Risk assessment and regulatory mechanisms. Recent trends in nanobiotechnology: Nanobots, targeted drug delivery; nanomaterials in agriculture; cosmetics; space elevators. (By resource persons from academia and industry)			
Module:8	**Contemporary issues:**		**2 hours**
Lecture by Industrial Expert			
	Total Lecture hours:	**45 hours**	

Text Book(s)

1. **Nanobiotechnology I:** Concepts, applications and perspectives, eds. CM Niemeyer, CA Mirkin, Wiley-VCH Verlag GmbH & Co., KgaA, Weiheim (2015)
2. **Nanobiotechnology II:** More concepts, applications and perspectives, eds. CA Mirkin,CM Niemeyer Wiley-VCH Verlag GmbH & Co., KgaA, Weiheim (2015)

Reference Books

1. **Bionanotechnology:** Lessons from Nature, David S. Goodsell, John Wiley & Sons - Science, ISBN: 978047146958 (2015)

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

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Course code	Course Title	L	T	P	J	C
BIT 3005	Biological Spectroscopy	3	0	0	4	4
Pre-requisite	BIT 1005	Syllabus version				
		2.0				

Course Objectives:

1. To identify and evaluate spectroscopic techniques spanning a wide range of the electromagnetic spectrum including visual (VIS), fluorescence, near infrared (NIR), infrared (IR), Raman and nuclear magnetic resonance (NMR) spectroscopy etc.
2. To analyze with the various spectroscopic tools for biomolecular quantitation and characterization.
3. To interpret in interdisciplinary mode to solve biological problems with the help of the knowledge in physical and chemical engineering.

Expected Course Outcome:

At the end of the course, students will be able to:

1. Outline basic concepts and physics behind the spectroscopic techniques.
2. Describe and interpret the basic concepts of spectroscopy.
3. Explain practical use of spectroscopy and discuss problems
4. Apply spectroscopy for process monitoring and quality control.
5. Evaluate real life challenges and recent trend in spectroscopy.

Student Learning Outcomes (SLO):	2,18

Module:1	Basics of quantum mechanics	5 hours

Schrodinger wave equation; atomic and molecular structures; transition energy states

Module:2	UV-Visible spectroscopy	5 hours

Selection rules; biological chromophores including charge transfer complexes; surface odelli resonance

Module:3	Fluorescence spectroscopy	6 hours

Biological fluorophores – intrinsic and extrinsic; quenching mechanisms; fluorescence probes; Fluorescence resonance energy transfer

Module:4	Infrared spectroscopy	6 hours

Selection rule; fundamental and harmonic transitions; normal mode analysis; amide bands I and II – characterisation and their application; ATR

Module:5	Raman spectroscopy	6 hours

Instrumentation; Strokes and antistrokes – Rayleigh scattering; selection rules; Amide bands I and II; Coherent Anti Stokes Raman Scattering

Module:6	XPS	5 hours

Instrumentation; XPS patterns; Spin orbital Splitting; Quantitative analysis; Chemical effect;

Chemical shift			
Module:7	**1D NMR**		**6 hours**
Boltzmann distribution; coupling constants; dipolar coupling; nuclear overhauser effect; NMR spectra of selected nuclei (H, C, P, F, N). Multidimensional NMR and other advanced Techniques: Multidimensional NMR; application to larger biomolecules; electron paramagnetic resonance, Auger electron spectroscopy			
Module:8	**Contemporary issues:**		**6 hours**
Lecture by Industrial Expert			
	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	Peter Atkins, Julio de Paula (2014) Atkins' Physical Chemistry, 10th Edition, Oxfod University Press, UK
Reference Books	
1.	Marques MP, Batista de Carvalho LAE, Haris PI (2013) Spectroscopy of Biological Molecules Ed. IOS Press, Netherlands

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Course code	Course Title	L	T	P	J	C
BIT 3007	Animal Biotechnology	3	0	2	0	4
Pre-requisite	BIT 1006	Syllabus version				
		2.10				

Course Objectives:

1.To explain various techniques used in animal cell culture, cell line authentication and characterization
2.To identify different methods used to deliver and manipulate genes in desired cells
3.To appraise the role of assisted reproductive techniques in the genetic conservation of farm and wild animals

Expected Course Outcome:

At the end of the course, students will be able to
1.Appraise the importance of animal cell culture techniques in the development of novel drug, cell and gene therapy products
2.Make use of the various techniques in cell line authentication and characterization, and identify contaminations in cell culture
3.Select from different gene delivery methods that are currently available based on the type of target tissue involved
4.Compare different methods used in assisted reproduction and identify the challenges in natural method of conception
5.Apply the principle of gene targeting methods used in the generation of animal models for biomedical research
6.Make use of the concept about molecular techniques in animal conservation

Student Learning Outcomes (SLO):	2,11,18

Module:1	Animal Cell Culture	5 hours

Historical background, importance of animal cell culture technology, serum and serum free media, culturing and sub-culturing of animal cells. Cell line characterization, contaminants in animal cell culture - their detection and control, applications of animal cell culture.

Module:2	Cell authentication and characterization	7 hours

Methods used for differentiating cells from diverse organisms and tissues, mitotic selection, synchronization in G1 phase, inhibitors of S phase, double block in synchronization, methods for evaluation of cell synchrony, characteristics of senescence and cancer cell growth in culture.

Module:3	Gene transfer to animal cells	6 hours

Physical, chemical and biological means of gene delivery systems for animal cells, Bacterial vectors, retrovirus vectors and baculoviral vectors for insect cells.

Module:4	Animal cell, embryo, and stem cell culture	5 hours

Primary and secondary cell culture, Cell immobilization techniques, Scaling up of animal cell culture, Cryopreservation. MEFs isolation. Protocols for Immortalization of cells. SiRNA technique.

Module:5	**Reproductive Biotechnology**	**6 hours**
Artificial Insemination-estrous synchronization; super-ovulation; embryo transfer, Immunological methods to control reproduction, monitoring reproductive status, *in-vitro* fertilization, sperm and embryo sexing; genetic diagnosis.		
Module:6	**Genetic manipulation**	**7 hours**
Somatic cell nuclear transfer, Stem cells and induced pluripotent stem cells, Production of transgenic mice, gene targeting technology, applications of transgenic mice, cattle, birds and fish, difficulties to apply standard transgenesis in other mammals.		
Module:7	**Advanced transgenic technology**	**7 hours**
Constitutive and inducible expression system for transgene expression in animals, Principle behind production of knockout mice, Cre/LoxP system. Animal models used in biomedical research such as cancer, diabetes, immunology and toxicology. Conservation Biology: Animal and human genome projects DNA sequencing; NGS and its applications, Ethical, Legal and Social implications in animal biotechnology; Molecular techniques in genetic conservation of farm animals.		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Primrose SB, Twyman RM (2015): Principles of gene manipulation and genomics, (8thedn). Wiley-Blackwell publishing, Oxford UK.
Reference Books	
1.	Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walter P (2014): Molecular biology of the cell, Garland Science, 6thedn, New York, USA.
2.	Bernard R Glick, Jack J Pasternak (2010) Molecular biotechnology: principles and applications of recombinant DNA, ASM press, 4thedn, Washington, DC, USA.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Challenging Experiments (Indicative)		
1.	Tryphan blue staining and cell counting	3 hours
2.	Primary culture technique in chicken embryo fibroblast	3 hours
3.	Secondary culture in chicken embryo fibroblast	3 hours
4.	Culture of animal cell lines	3 hours
5.	Subculture and freezing of animal cells	3 hours
6.	Isolation of mouse embryonic fibroblast	3 hours
7.	Isolation of lymphocytes from mice spleen	3 hours
8.	Animal handling techniques	3 hours
9.	Different routes and drug administration to mice and rats	3 hours
10	Organization and maintenance of genetically modified animals in lab	3 hours

		Total Laboratory Hours	**30 hours**
Mode of evaluation:			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Course code	Course Title	L	T	P	J	C
BIT 3008	Plant Biotechnology	3	0	0	4	4
Pre-requisite	BIT 1006	Syllabus version				
		3.0				

Course Objectives:

1.Illustrate the physiological processes operating in plants
2. Learn the plant tissue culture methods
3.Acquire knowledge of biotechnological tools which help in modifying plants suited to agriculture and industry

Expected Course Outcome:

At the end of the course, students will be able to:
1. Describe concepts on the physiological processes and genome organization in plant
2. Apply plant tissue culture and transgenic technology to develop genetically engineered crop plants
3. Outline various components involved in developing transgenic plants
4. Discuss the production of new bio-molecules in plant using transgenic technology
5. Compare and apply molecular marker technology in plant breeding
6. Design and develop innovative applications in the field of genetic engineering (J component)

Student Learning Outcomes (SLO):	2, 6

Module:1	Plant physiology	6 hours

Photosynthesis, respiration, phyto-hormones, photoperiodism and flowering, plant signaling and behavior [plant communication]

Module:2	Organization of genetic material	5 hours

Nuclear, chloroplast and mitochondrial genome. Gene structure and regulation of gene expression.

Module:3	Plant tissue culture	5 hours

Differential plasticity and totipotency, culture environment, culture media, plant growth regulators and its applications, culture types, regeneration (somatic embryogenesis and organogenesis) and hardening. Applications of plant tissue culture.

Module:4	Plant transformation	6 hours

Direct (particle bombardment, PEG mediated transformation, electroporation, silicon carbide fibre) and indirect gene transformation (Agrobacterium and viral mediated transformation).

Module:5	title	6 hours

Binary vectors, Gateway cloning and RNAi vectors. Promoters, terminators, markers involved in designing an expression cassette. Gene silencing. Clean gene technology. Plastid transformation.

Module:6	Transgenic Technology	7 hours

Production of genetically modified plants for herbicide tolerance [Round Up Ready], biotic and abiotic stress tolerance, improvement of quality traits [Fortified rice], technology protection

systems and risks of transgenes in ecosystems.			
Module:7	**Molecular pharming and marker assisted breeding**		**8 hours**
Plantibodies, edible vaccines, bioplastics and industrial products. Phenotypic and enzyme markers. Molecular markers (co-dominant and dominant markers). Introduction to linkage analysis and QTL mapping. Marker assisted selection and map based cloning.			
Module:8	**Contemporary issues:**		**2 hours**
Lecture by Industrial Expert			
	Total Lecture hours:	**45 hours**	

Text Book(s)

1.	Adrian Slater, N W Scott, M Fowler, Plant Biotechnology: The Genetic Manipulation of Plants, second Edition, 2014, Oxford University Press.

Reference Books

1.	M.K. Razdan. 2014. Introduction to Plant Tissue Culture. 2nd Edition, Oxford and IBH Publishing Company, India.
2.	Wang, Aiming and Ma, Shengwu. 2014. Molecular Farming in Plants: Recent Advances and Future Prospects. Springer, New York, USA.
3.	Edwin F. George, Michael A. Hall and Geert-Jan De Klerk. 2014. Plant propagation by tissue culture. 3rd Edition. Springer, The Netherlands.
4.	Roberta Smith. 2012. Plant tissue culture: Techniques and experiments, 3rd Edition, Academic Press, Elsevier Inc., USA.
5.	Lincoln Taiz, Eduardo Zeiger, Ian M. Møller, and Angus Murphy. 2015. *Plant Physiology and Development*, Sixth Edition. Sinauer Associates Inc; USA.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

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Course code	Course Title	L	T	P	J	C
BIT 3009	Forensic Science and Technology	3	0	0	4	4
Pre-requisite	BIT 2006	Syllabus version				
		2.1				

Course Objectives:

1. Explain the methods and principles of forensic investigations and how forensic science can be applied in criminal investigations.
2. Apply basic scientific principles of forensic science applied in solving criminal cases.
3. Examine the various areas of Forensic Sciences including Crime scene Investigation, Forensic photography, Digital Forensics, Ballistics, Fingerprinting, Court and police organizational structures and Forensic DNA analysis.

Expected Course Outcome:

At the end of the course, student will be able to:
1. Explain the basic terminology for forensic science correctly and contextually.
2. Define the basic organizational structures and procedures within forensic sciences.
3. Explain concepts, principles and significance of impression evidence.
4. Describe the practices behind collection, analysis and interpretation of evidences
5. Demonstrate the capabilities in theory, laboratory techniques in analyzing body fluids, computer analysis and other evidence analysis.

Student Learning Outcomes (SLO): 2,4,7

Module:1	Introduction to Forensic Science	6 hours

History and Significance, Crime scene investigative procedures, Experts involved in forensic investigations, Forensic laboratories: National and Global laboratories, Body farms: Recent advances

Module:2	Crime Scene Profiling, and Instrumentation	6 hours

Physical evidences, Evidence collections, Documentation, Chain of Custody, Instrumentation in Forensic Analysis

Module:3	Fingerprints in Forensics	6 hours

Principle, Types, Fingerprint lifting techniques, Modus Operandi Sheet preparation

Fingerprint Recorders: Biometric system in detecting individual variation, Optical, Capacitance-based and other types of fingerprint recorders

Module:4	Impressions, Documents, and other Evidences in Forensic Analysis	5 hours

Impression based evidence analysis (Principle, Tool markings, Tire, Footwear markings and associated databases), Hand writing analysis, Question documents, Polymers and Fibers

Module:5	Ballistics	5 hours

Types, application, forensic ballistic procedures (internal, external and terminal ballistics) and identification of firearms, Available ballistic databases

Module:6	**Blood, Toxicology Profiling in Forensic Evaluation**	**5 hours**
Serological analysis (blood, saliva, semen etc.), Blood Splatter- Origin of impact study Abusive Drug types, CSA- schedules, Poisons and analysis		
Module:7	**Pathology and DNA fingerprinting in Forensics**	**5 hours**
Time of death analysis; Entomology and pathology in death analysis, Bite-mark analysis, Forensic Medicine. DNA fingerprinting: RFLP and PCR (VNTR, STR-CODIS) based probes. **Forensic Photography and Digital Criminolistics**: Principle application of SLR-camera, Digital camera, CCTV in forensic analysis, Camera techniques for evidence visualization, Forensic Facial Reconstruction **Cyber Forensics**: Computer, Mobile phone data analysis, Ethical hacking, drones, remote surveillance in forensic investigations, and Corporate crimes, deception detection tests (DDT): polygraph, narco-analysis and brain-mapping Forensic and Legal proceedings in India: Legal proceedings in forensics, CSI in India, and Case study		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**40 hours**

Text Book(s)

1.	Criminalistics: An Introduction to Forensic Science, 11/E, Richard Saferstein, ISBN-10: 0133458822 • ISBN-13: 9780133458824, 2015 • Prentice Hall

Reference Books

1.	Forensic DNA Typing, 2nd Edition, Biology, Technology, and Genetics of STR Markers, J Butler,2005, Imprint: Academic Press, eBook ISBN : 9780080470610, Print Book ISBN : 9780121479527, Pages: 688
2.	Forensic Chemistry: Fundamentals and Applications. Jay Siegel. ISBN: 978-1-118-89772-0. 2015, Wiley-Blackwell.
3.	Current Practice in Forensic Medicine, Volume 2. John A. M. Gall (Editor), Jason Payne-James (Editor) ISBN: 978-1-118-45598-2, 2016, Wiley-Blackwell.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Vellore Institute of Technology
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Course code	Course Title	L	T	P	J	C
BIT 3010	Food Process Technology	2	0	0	4	3
Pre-requisite	BIT 1008	Syllabus version				
		2.10				

Course Objectives:

1. To realize the importance of food processing methods
2. To give the basics in nano - food technology.
3. To comprehend the various steps involved in food product development.

Expected Course Outcome:

At the end of the course, student will be able to:

1. Use their knowledge on biotechnology to the science of food.
2. Describe the scope of food processing.
3. Explain the principle involved in food processing.
4. Discuss the science and technology involved in preservation of food.
5. Restate the application of nanotechnology in food processing.
6. Outline the basics of quality control and assurance practiced in food processing.

Student Learning Outcomes (SLO):	2,9

Module:1	Food processing industries	3 hours

Scope of food processing industries; categories; case study- Indian scenario

Module:2	Introduction to food process technology	4 hours

Overview of types of raw materials, cleaning, sorting and grading of materials

Module:3	Principles of processing and preservation	4 hours

Principles and methods of food processing; effects of processing on food products.

Module:4	Heat processing	4 hours

Blanching, pasteurization, sterilization, evaporation, extrusion, dehydration, dielectric and infrared heating.

Module:5	Processing by removal of heat	4 hours

Chilling, freezing, freeze drying, and vacuum cooling of foods.

Module:6	Advanced technologies in food processing	4 hours

High pressure processing of foods, enzyme assisted food processing, PEF technology, food irradiation, green technologies.

Module:7	Nano Food Technology	5 hours

Nano materials as food components, food packaging and nano materials, policies on usage of nanomaterials in foods. Food product development: steps involved in food product development, shelf life assessment, key concepts in quality control and assurance, ISO 22000, FSSAI 2012.

Module:8	**Contemporary issues:**		**2 hours**
Lecture by industrial expert			
	Total Lecture hours:	**30 hours**	

Text Book(s)	
1.	P.J. Fellows.2009. Food Processing Technology -Principles and Practice (Third Edition). A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition.
Reference Books	
1.	Rahman, Mohammad Shafuir, and Ahmed, Jasim. 2012. Handbook of Food Process Design. Hoboken, NJ, USA: Wiley-Blackwell.
2.	Brennan, James G, and Grandison, Alistair S., eds. 2011. Food Processing Handbook. Hoboken, NJ, USA: Wiley-VCH.

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No.46	Date	23-08-2017

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Course code	Course Title	L	T	P	J	C
BIT 3011	Plant Cell and Tissue Culture	2	0	4	0	4
Pre-requisite	BIT2006	Syllabus version				
		2.10				

Course Objectives:

1.Demonstrate the basic concepts of *in vitro* propoagation
2.Develop the capabilities of media preperation, comprehension and applications of plants in cell and tissue culture systems
3.Construction of ability on Scaling up of secondary metabolites under *in vitro* conditions

Expected Course Outcome:

At the end of the course, students should be able to:
1.Illustrate the basic concepts of aseptic growth conditions and propagation techniques
2.Interpret the use different sterilization techniques in appropriate condition
3.Acquire the capabilities of usage on appropriate synthetic media and explants for PTC
4.Make use of *in vitro* and plant physiological factors influencing the growth and development
5. Utilize the techniques on commercial micropropagation, production and germplasm conservation.
6. Make use of the practical skills and confidence on scale up of secondary metabolite production

Student Learning Outcomes (SLO):	2, 6, 14

Module:1	History	3 hours

Origin and chronology of important developments in plant tissue culture. Asexual reproduction in plants. Hydroponics.

Module:2	Laboratory requirements	2 hours

Organization, aseptic manipulation and environmental conditions.

Module:3	Tissue culture media	4 hours

Source and role of macro nutrients, micro nutrients, plant growth regulators, carbon source, vitamins, supplements and gelling agents.

Module:4	Types of culture and their importance	6 hours

Totipotency and plasticity. Explants. Callus, cell-suspension, protoplast, leaf, nodal, root, shoot, meristems, embryo and microspore cultures. Usage of different types of media (Hoagland solution, Murashige and Skoog's, Gamborg's, Nitsch's and White's media) for varied cultures.

Module:5	Regeneration pathways	4 hours

Direct and indirect somatic embryogenesis and organogenesis. Primary hardening, secondary hardening and green house conditions.

Module:6	Scope in crop improvement	5 hours

Somaclonal variants, haploid and polyploid plant development, somatic hybridization, *in vitro* pollination, embryo rescue and wide hybridization, propagation of transformed explant/callus,

screening for stress and germplasm conservation.			
Module:7	**Commercial products and industrial startups**		**4 hours**
Mass production of micropropagules, secondary metabolites and artificial seeds. Pilot scale manufacturing of plant metabolites through elicited suspension cultures. Requirements to set up a commercial tissue culture lab.			
Module:8	**Contemporary issues:**		**2 hours**
Lecture by Industrial Expert			
	Total Lecture hours:	**30 hours**	

Text Book(s)	
1.	M.K. Razdan. 2014. Introduction to Plant Tissue Culture. 2nd Edition, Oxford and IBH Publishing Company, India.
Reference Books	
1.	Gamborg O. L, Phillips G.C. 2013. Plant cell, tissue and organ culture: fundamental methods, Narosa Publishing House, India.
2.	Edwin F. George, Michael A. Hall and Geert-Jan De Klerk. 2014. Plant propagation by tissue culture. 3rd Edition. Springer, The Netherlands.
3.	Roberta Smith. 2012. Plant tissue culture: Techniques and experiments, 3rd Edition, Academic Press, Elsevier Inc., USA.
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

List of Challenging Experiments (Indicative)		
1.	Study on the design and structure of a plant tissue culture laboratory and greenhouse	5 hours
2.	Aseptic techniques - wet sterilization, filter sterilization, irradiation, chemical sterilization and laminar airflow chamber	5 hours
3.	Preparation of stock solutions of basal medium, organic supplements and plant growth regulators; preparation of plant tissue culture media	5 hours
4.	Surface sterilization of explants, inoculation and micropropagation of plants	5 hours
5.	Zygotic embryo culture, leaf bit, root bit, shoot tip, nodal and microspore culture	5 hours
6.	Sub culturing and development of friable calli	5 hours
7.	Preparing a suspension culture from friable calli and plotting the growth curve	5 hours
8.	Protoplast isolation and fusion	5 hours
9.	Direct/indirect organogenesis; Shooting and rooting	5 hours
10	Somatic embryogenesis and preparation of artificial seeds	5 hours
11	Co-culturing of explant and callus; floral dip with *Agrobacterium tumefaciens*; studying carrot tissue proliferation on transformation with T DNA; screening of transformed tissue	5 hours
12	Hardening techniques; growing in coco peat trays; secondary hardening	5 hours
	Total Laboratory Hours	**60 hours**

Recommended by Board of Studies	03-08-2017		
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Course code	Course Title	L	T	P	J	C
BIT 4001	Bioprocess plant design, Economics and Optimization	3	0	0	0	3
Pre-requisite	NIL	Syllabus version				
		3.0				

Course Objectives:

1.Outline the concepts of process design
2.Construct design methods for specific plant items
3.Develop skills in process flow sheeting

Expected Course Outcome:

At the end of the course, students should be able to:
1. Apply chemical and process engineering knowledge to the design of a process plant.
2.Determine the feasibility of a process for chemical and material manufacture
3.Apply the operation research concept in biological systems
4.Assess the economic/profitability of a process
5.Design a safe and environmentally acceptable process
6.Develop individually or as a team on process and equipment design

Student Learning Outcomes (SLO): 1,2,5

Module:1	Process Design Development	6 hours

Mod Types of Designs, Feasibility Survey, Flow Diagrams, Specifications sheet preparation ule content

Module:2	General Design Considerations	6 hours

Factors Considered in a Plant Site Selection and Plant Layout preparation, Cost and Asset Accounting

Module:3	Cost Estimation	6 hours

Cash Flow for an Industrial Operations, Factors affecting Investment and Production Costs, Calculation of Total Capital Investment of the Process plant. Break Even Point analysis

Module:4	Depreciation Techniques	6 hours

Basic Terms, Straight line method, Depletion method, Declining balance method, Sum of the years digit method, Sinking fund method.

Module:5	Interest and Investment Costs	6 hours

Types of Interest, Present Worth and Discount, Annuities, Relation between Amount of Ordinary Annuity and the Periodic Payments, Present Worth of an Annuity, Perpetuities and Capitalized Costs

Module:6	Methods of Capital Budgeting	6 hours

Traditional methods – Rate of Return and Payback period; Discounted cash flow methods - Internal Rate of Return, Net present value and Profitability index**.**

Module:7	**Optimization techniques**	**7 hours**
General Procedure For Determining Optimum Conditions – Analytical and Graphical Procedure, Comparison of Graphical and Analytical Methods. Linear Programming Graphical Solution The Simplex Algorithm, Big-M Method and Dynamic programming.		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Peters and Timmerhaus, 2013. Plant design and Economics for Chemical Engineers, McGraw Hill 6th Edition.
Reference Books	
1.	Smith, R. Chemical Process Design and Integration, Wiley Student Edition, 2010.
2.	Seider, W.D., Seader, J.D. and Lewin, D.R. Product and Process Design Principles - Synthesis, Analysis and Evaluation, 2nd Ed.John Wiley and Sons Inc., 2004.
3.	Biegler, L.T., Grossmann, I.E., and Westerberg, A.W. Systematic Methods for Chemical Process Design, Prentice-Hall, 2014
4.	Baasel, W.D. Preliminary Chemical Engineering Plant Design, Van_Nostrand Reinhold, 2nd Ed., 2013
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Course code	Course Title	L	T	P	J	C
BIT4002	Medical Diagnostics	3	0	0	4	4
Pre-requisite	BIT1005	Syllabus version				
		1.1				

Course Objectives:

1. To acquire the knowledge about various types of specimen received in the diagnostic laboratory
2. To understand the procedures carried out in different laboratories
3. To understand the molecular diagnostic and imaging tools to assist the clinical diagnosis.

Expected Course Outcome:

At the end of the course, students should be able to:

1. Describe the basis of clinical and haematological tests
2. Explain various techniques in histopathological laboratory.
3. Outline the process to diagnose common infections
4. Recite the recent rapid diagnostic tests
5. Discuss and classify the diagnostic techniques that uses immuno-cytochemistry
6. List the common imaging techniques and their applications

Student LearningOutcomes (SLO):	2,14

Module:1	Hematology	6 hours

Hematology: Smearing and staining Methods, Osmotic fragility test, Cell counting variations – RBC, WBC, Platelets, Eosinophil & Reticulocyte count, ESR, LE Cell. Haemopoeisis – Erythrocytes, Hemoglobin – Estimation, Packed Cell Volume, indices. Hematocrit and Red cell indices, Anemia, Coagulation Factors, Coagulation disorders –Bleeding & Clotting Time, Bone marrow study.

Module:2	Histology and Cytology	8 hours

Histology and Cytology: Histological Procedures Biopsy, Autopsy, Collection, Preservation & Labeling of Slides, Blocks, Specimens, Techniques, Grossing Methods, Fixatives, Processing of the tissues including Bone, Embedding, Section Cutting,Staining & Mounting, Special Stains Preservation of reports & records. Techniques Equipment &Procedures-FNAC, Imprints smear, Vaginal& Buccal smear, Swabs. Staining procedure and Mounting, Preparation of fluids for Cytological Examination, Immunohistochemistry and In situ hybridization.

Module:3	Diagnostic medical microbiology	6 hours

Diagnostic medical microbiology: Microbial pathogenesis, Collection, culturing, identification procedures: Updated immunologic or molecular diagnostic tests. The diagnostic laboratory tests for identification of *Staphylococcus aureus, E.coli, shigella, Salmonella etc.,* including bacteriologic methods for isolation, serologic methods of diagnosis. Test for bacterial Sensitivity tests against antimicrobial agents and clinical implications, their interpretation. Specific culture and drug sensitivity methods.

Module:4	**Recent advances in Medical Microbiology**	**6 hours**
Recent advances in Medical Microbiology: Torch profile, myco, dot, lgG, lgA, lgM and lgE testing, Australia Ag (HbsAg) etc.		
Module:5	**Laboratory Diagnosis of Virus Infection**	**6 hours**
Laboratory Diagnosis of Virus Infection: Viral pathogenesis Specimen collection and submission, Cultivation & assays for virus, Purification & identification of virus, Serological tests and rapid diagnostic tests.		
Module:6	**Immunopathological Methods in Clinical laboratories**	**6 hours**
Immunopathological Methods in Clinical laboratories: Detection of various allergic agents and immunopathology of allergy. Rheumatological diseases: Pathogenesis and Lab diagnosis. Cancer immunology & Tumor markers. Tissue typing for Kidney transplant & bone marrow transplant. Laboratory investigations in megaloblastic anaemias (lron deficiency, megaloblastic, haemolytic). Pathogenesis and laboratory investigations in Leukemia's.		
Module:7	**Radiology and Advanced Imaging Techniques**	**5 hours**
Radiology and Advanced Imaging Techniques: Introduction to Radiology- X Ray, Ultrasound, MR, CT, PET, Radiographic, High-throughput diagnostics in clinics: DNA chips, diagnosis of genetic disorders, human genome project in diagnostics and Microarrays; ethical considerations.		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)

1.	Fischbach, Lippincott (2014) A Manual of Laboratory and Diagnostic Tests, 9th Edition,Williams & Wilkins India. Connie Mahon, George Manuselis (2014) Textbook of Diagnostic Microbiology, 5th Edition, Saunders Co.

Reference Books

1.	Koneman, Allen, Janda, Schreckenberger, Winn Lippincott (2006) Color Atlas and Textbook of Diagnostic Microbiology.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Course code	Course Title	L	T	P	J	C
BIT 4003	Molecular modeling and drug design	3	0	0	0	3

Pre-requisite	BIT 2006	Syllabus version
		2.10

Course Objectives:

1.To explain the theoretical background of molecular mechanics force fields and basic background of drug designing concept
2.To illustrate the behavior of biomolecules using computer software's
3.To infer their application using various tools related to molecular modeling

Expected Course Outcome:

At the end of the course, students should be able to:
1. Classify the quantum mechanics and various approximation method
2. Explain the protein structure and function
3.Analyze biomolecules with various molecular mechanics force fields
4.Create the bioactive molecules in the process of drug discovery
5.Apply concepts molecular modeling to industrial problems
6.Apply concepts of drug designing to industrial problems

Student Learning Outcomes (SLO): 2, 9,17

Module:1	Quantum mechanics & concepts in molecular modeling	8 hours

Introduction – coordinate systems, potential energy surfaces. Introduction to quantum mechanics: Schrodinger wave equation, Born-Oppenheimer approximation. Introduction to computer hardware and software

Module:2	Biomolecules	7 hours

Overview of Biomolecules - protein structures and classifications, Protein folding and Ramachandran plot

Module:3	Force Fields	7 hours

The simple molecular mechanics force field and general features; bond stretching; angle bending; torsional terms; non-bonded interactions; electrostatic interactions; van der Waals interactions; steepest descent method, conjugate gradient method

Module:4	Analysis and Properties	6 hours

Geometry optimization, Vibrational frequencies: potential energy surface, harmonic vs. fundamental frequencies, zero-point vibrational energies (ZPVE's).

Module:5	Modeling	5 hours

Steps in homology modeling, tools, databases, side chain modeling, loop modeling. Predicting Protein Structures by Threading

Module:6	**Drug design**	**5 hours**
Deriving and using 3D pharmacophores. Structure-based methods to identify lead compounds: finding lead compounds by searching 3D databases; de novo ligand design		
Module:7	**Molecular Docking**	**5 hours**
Docking - molecular modeling in drug design – structure based drug design, AUTODOCK and HEX. **Visualization tools for molecular systems** : Visualizing Molecular Dynamics trajectories, VMD, YASARA, PyMOL		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Andrew R. Leach, Molecular Modeling, Principles & Applications, 2nd ed (Dorling Kindersley(india) (P)Ltd with pearson education Ltd, UK, 2010
Reference Books	
1	R.K. Prasad, Quantum Chemistry, 4th ed. (New Age international (P) Ltd, ND, 2010)
2.	Alan Hinchliffe, Molecular Modelling for Beginners, 2nd ed, John-Wiley, 2010
3.	S. C. Rastogi, Namita Mendiratta, Parag Rastogi, Bioinformatics: Methods And Applications: (Genomics, Proteomics and Drug Discovery), 3rd ed, PHI learning (P) Ltd, 2010
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

Recommended by Board of Studies	03-08-2017		
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Course code	Course Title	L	T	P	J	C
BIT 4004	Tissue Engineering	3	0	0	4	4
Pre-requisite	BIT 2006	Syllabus version				
		2.10				

Course Objectives:

1.To identify, formulate and adapt tissue engineering solutions to unmet healthcare needs
2.To learn biomaterial fabrication and their biological outcomes with respect to site specific applications
3. To provide students with the conceptual and problem solving framework for studying and conducting tissue engineering related activities.

Expected Course Outcome:

At the end of the course, students should be able to:
1. Recite the multidisciplinary aspects in tissue engineering and its usefulness to solve healthcare problems
2.Identify sources of cells, bioactive molecules and materials
3.Design and develop scaffolds using conventional and advanced fabrication methods
4.Evaluate biological outcomes of tissue engineering strategies
5.Describe the regulatory aspects to commercialize products
6.Define site and patient specific applications

Student Learning Outcomes (SLO):	2, 5, 18

Module:1	Introduction & History	5 hours

Tissue and organ banking; limitations of banking; types of tissues; organ and tissue culture in vitro; origin of tissue engineering; history (with respect to skin TE); scopes

Module:2	Morphogenesis & cell sources	8 hours

Morphogenesis and organ development in human; repair and regeneration; cell sources; stem cells and its types; Differentiation, differentiation and trans-differentiation; Intercellular communication- gap junctional and microvescular; Cell aggregation; adhesion dependence; Role of ECM in term of decellularized allo-/xeno-genic tissues in tissue engineering

Module:3	ECM analogues and biomaterials	7 hours

Definition, ideal properties and types; biomimetics; Properties like -- mechanical property, wetability, biodegradability and surface property; Types -- polymeric (natural and synthetic), nano-materials, ceramic, composites, hydrogels and metallic

Module:4	Scaffolds	7 hours

Definition, 3-dimentionality; porosity and pore-size; fabrication technology: conventional (such as Solvent-casting particulate-leaching Gas foaming, electrospinning, fiber meshes/ fiber bonding, phase separation, freeze drying, solution casting) and solid free form technology (such as stereo-lithography, 3D printing, fused deposition modeling, phase-change jet printing)

Module:5	Bioactive molecules	6 hours

Types, growth factors, peptides, genes; barriers in drug delivery; drug delivery mechanisms; controlling factors (dissolution, diffusion, osmotic, chemical and environment); release kinetic models; barriers in drug delivery		
Module:6	**Histo-Techniques**	**5 hours**
Microtomy, histochemical staining; whole mount staining and imaging, immunostaining and imaging, 3D imaging techniques, electron microscopy; histomorphometry		
Module:7	**Engineering of specific tissues**	**5 hours**
in vitro tissue models for drug testing; regenerative templates; bioreactor design principle for TE; engineered tissues like -- musculoskeletal, nerve and cardiac; TE advances and current trends. TE Products: Regulations, guidelines, clinical trials and commercialization (case studies)		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Palsson, Bhatia (2016) Tissue Engineering, Pearson Education India.
2.	Robert P Lanza, Robert Langer, Vacanti JP (2013) Principle of Tissue Engineering, 4th Edition, Academic Press
Reference Books	
1.	Ravi Birla, (2014) Introduction to Tissue Engineering: Applications and Challenges, Wiley-IEEE Press.
2.	Robert A. Brown, (2012) Extreme Tissue Engineering: Concepts and Strategies for tissue fabrication, Wiley Blackwell.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Course code	Course Title	L	T	P	J	C
BIT 4005	Genomics	3	0	0	0	3

Pre-requisite	BIT 2006	Syllabus version
		2.10

Course Objectives:

1. To provide knowledge on the genomes of different life forms, organization, function and analytical techniques for application in Biotechnology industries
2. To instill in those students who successfully complete the course sufficient knowledge for them to be conversant in all of the areas of genomics
3. The course will be to develop skills in experimental design within the context of learning about biology including: DNA sequencing, personalized medicine, various data base analysis, comparative genomics and metabolic pathways.

Expected Course Outcome:

At the end of the course, students should be able to:

1. Define- Various genomes, their sequencing techniques and functional analytical approaches
2. Describe the advances in genomics, transcriptomics, metabolomics and proteomics
3. Integrate various information from genomic and proteomic databases for modeling.
4. Use bioinformatics and genome databases
5. Explain application of genomics in pharma, food and agri, bioprocess industries and in medical biotechnology field.
6. Formulate and investigate genomic research questions, and to effectively communicate such questions, methods, and results.

Student Learning Outcomes (SLO):	2, 4, 18

Module:1	Genomics – Overview and Introduction	6 hours

Genomes – Prokaryotes, Eukaryotes, Organelles (Mitochondria, Chloroplast), Sequence complexity – introns, exons, intron-exon boundary, splicing.

Module:2	High-throughput sequencing techniques and NGS Data Output	5 hours

Automated DNA sequencing, Pyro-sequencing, Membrane sequencing –Overview of Techniques [Principles of SOLiD™, GS-FLX, Ion- Torrent, Illumina Solexa], Output and analysis in Next Generation Sequencing

Module:3	Human Genome	8 hours

Genome Mapping, Gene Families and Editing, Goals and Benefits of HGP, Drawback and ELSI issues, HAPMAP, GWAS, Gut Microbiota Projects; MicroRNA biogenesis, siRNA and miRNA Action, microRNA functions.

Module:4	Comparative genomics and expression Profiling	7 hours

Comparative genomics Concepts, Mutagenesis and Interference, Gene knockouts, RNA

Expression Studies – Single locus and Global - Spotted DNA arrays, Printed oligonucleotide chips, SAGE, DDRT, MPSS – Data acquisition and analysis		
Module:5	**Pharmacogenomics and Personalized Medicine**	**7 hours**
Concepts and Tools in Pharmacogenomics, Pharmacogenetics V/s Pharmacogenomics; Understanding drug responses, Pharmacogenetic Markers of Drug Efficacy and Toxicity, Gene disease association; Pharmacogenomics and individualized drug therapy		
Module:6	**Metagenomics**	**5 hours**
Concept, Methods and techniques involved Data output and analysis Metagenomics projects at NIH.		
Module:7	**Genome databases**	**5 hours**
NCBI, EBI ENSEMBL Human Genome Server, JGI Databases, The UCSC Genome Browser database, RefSeq: an update on mammalian reference sequences, Consensus Coding Sequence database. **ELSI in Genomics Studies**: Ethical Issues and Genetic Discrimination: Genomics and Society Genomic Privacy Advantages & Issues of Genome Diagnoses, Eugenics And Euphenics.		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)

1.	Arthur, L. 2014. Introduction to genomics. 2nd Edition, Oxford University Press, London, UK.
2.	Saraswathy, N. and Ramalaingam, P. 2011. Concepts and techniques in genomics and proteomics. 1st edition, Elsevier Science, Amsterdam, Netherlands.

Reference Books

1.	Starkey, M. and Elaswarapu, R. 2010. Genomics: Essential methods. 1st Edition, John Wiley and Sons, New Jersey, USA.
2.	Yin Yao, S. 2012. Applied computational genomics. 1st Edition, Springer, Netherlands.
3.	Deverajan, T. and Sangeetha, J. 2015. Genomics and proteomics: Principles, technologies and applications. 1st Edition, Apple Academic Press, New Jersey, USA.
4.	Atta-ur-Rahman. 2016. Advances in genome science. 1st Edition, Bentham Science Publishers, UAE.
5.	Singleton, P. 2012. Dictionary of DNA and genome technology, 1st Edition, John Wiley and Sons, New Jersey, USA.
6.	Korf, B.R. and Irons, H.B. 2012. Human genetics and genomics. 1st Edition, John Wiley and Sons, New Jersey, USA.
7.	Xia, X. 2013. Comparative genomics. 1st Edition, Springer, Berlin, Heidelberg, Germany.

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Course code	Course Title	L	T	P	J	C

BIT 4006	Neurobiology and Cognitive Science	3	0	0	4	4
Pre-requisite	BIT 1006	Syllabus version				
		2.10				

Course Objectives:

1.To introduce basic concepts about the organization, structure, and function of the human central nervous system;

2.To enable students to apply these fundamental principles toward understanding nervous system function and dysfunction and toward clinical problem-solving in relation to disorders that affect the nervous system, with emphasis on the central nervous system;

3.To provide the necessary foundation in neuroscience upon which students can build for the rest of their professional careers.

Expected Course Outcome:

At the end of the course, students should be able to:

1.Define the molecular, cellular, and tissue-level organization of the central and peripheral nervous system

2.Relate the properties of individual cells to their function in organized neural circuits and systems

3.Outline the properties of cells that make up the nervous system including the propagation of electrical signals used for cellular communication

4. Restate basics of neural pathology and pathogenesis.

5.Identify the basic concepts of the mind and brain that defines the discipline of cognitive science.

6. Formulate a research question and design an original research plan to address an original research question

Student Learning Outcomes (SLO):	2,10, 18	
Module:1	**Introduction**	**6 hours**

History, cytology of neurons, synthesis and trafficking of neuronal protein, sensation and perception, cognition and behaviour, anatomical organization of the central nervous system

Module:2	**The Neural Basis of Cognition**	**7 hours**

Functional organization of perception and movement, integration of sensory and motor function, Coding of sensory information, bodily senses, touch, perception of pain, visual processing, perception of motion, depth and form, sensory transduction in the ear, chemical senses (smell and taste)

Module:3	**Synaptic Transmission**	**6 hours**

Signaling at the nerve-muscle synapse, synaptic integration, modulation of synaptic transmission, transmitter release, neurotransmitters, synaptogenesis, myasthenia gravis

Module:4	**Electrical Properties of Neuron**	**6 hours**

Subtypes of Ion Channels, membrane potential, local signaling, action potential

Module:5	**Development of Nervous System**	**6 hours**

Induction and patterning of the nervous system, generation and survival of nerve cells, guidance

of axons to their targets, formation and regeneration of synapses, sensory experiences and the fine tuning of synaptic connections, neurogenesis, neural plasticity		
Module:6	**Arousal, Emotion and Behaviour Homeostasis**	**6 hours**
Brain stem modulation of sensation, movement and consciousness, seizures and epilepsy, sleep and dreaming, emotional states and feelings, motivational and addictive states		
Module:7	**Diseases of Nervous System**	**6 hours**
Neurobiology of affective disorders or mood disorders; dopamine and addiction; current research on Alzheimer's disease, Parkinson's disease, Huntington's disease, autism spectrum disorders (ASD), Depression, Anxiety, multiple sclerosis and Japanese encephalitis. **Methods in Neurobiology**: Single neuron recording, intracellular recording, extracellular recording, ECG, EEG, lesion and stimulation of brain, MRI, fMRI, PET, CAT, Morris water maze assay		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Principles of Neural Science. Kandel E.R., Schwartz J.H. and Jessell T.M., McGraw Hill, 2015.
Reference Books	
1.	Molecular and Cellular Physiology of Neurons (2005) . Fain G.L.Harvard University Press
2.	APA. DSM-IV: Diagnostic and Statistical Manual of Mental Dis- orders. Washington, DC: American Psychological Association; 2013
3.	Gage, Kempermann and Song (2008). Adult Neurogenesis. Cold Spring Harbor Laboratory Press
4.	R A Webster (2002). Neurotransmitters, Drugs and brain functions
	Authors, book title, year of publication, edition number, press, place

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

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University Electives

Course code	Course Title	L	T	P	J	C
BIT 1026	Food, Nutrition and Health	3	0	0	0	3
Pre-requisite	NIL	Syllabus version				
		2.10				

Course Objectives:

1. Build knowledge and an overview on general aspects of nutrition and health.
2. Distinguish the nutritive value of various food items, BMI calculation differentiating super junk, and functional foods in the market.
3. Solve the real-world problems based on nutrition and health

Expected Course Outcome:

1.Explain the nutritional values of the various types of foods
2.Analyze the role of food in the metabolic activity of the healthy diet
3. Infer the BMI calculation and stress related diseases.
4. Elaborate the independent decision on the choice of food to prevent life style disorders and diseases
5. Assess about the food laws governance
6. Compare junk, modified and super foods

Student Learning Outcomes (SLO):	2,3	
Module:1	**Nutrients in Food**	**6 hours**

Macro nutrients- carbohydrates, proteins and lipids. Micronutrients-Minerals: Calcium, Magnesium, Iron, Zinc, Copper and Selenium; Vitamins.

Module:2	**Nutritional Physiology**	**6 hours**

Digestion, absorption, and utilization of major and minor nutrients.

Module:3	**Energy Calculation**	**6 hours**

Energy balance and methods to calculate individual nutrient and energy needs. Planning a healthy diet.

Module:4	**Food Related Nutritional Disorders I**	**6 hours**

Causes of life style and stress related diseases. Cardio-vascular diseases, hypertension, obesity,

Module:5	**Food Related Nutritional Disorders Ii**	**6 hours**

Cancer, diabetics, ulcers, electrolyte and water imbalance. Health indices. Preventive and remedial measures.

Module:6	**Food and Health**	**7 hours**

Functional and "Super" Foods - role in optimal nutrition. Sugar, protein and fat substitutes. Food and behavior- physiological disturbances in alcoholism, drug abuse and smoking.

Module:7	**Food Related Laws.**	**6 hours**

Inspection – Microbial Indicators of product quality – Indicators of food safety –

Microbiological safety of foods - control strategies – Hazard Analysis Critical Point System (HACCP concept)- Microbiological criteria			
Module:8	**Contemporary Issues**		**2 hours**
Lecture by Industrial Expert			
	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	Nutrition- Concepts and Controversies. 2014. Frances Sienkiewicz Sizer and Ellie Whitney, 13e. Thompson Wadsworth.
Reference Books	
1.	Understanding Nutrition. 2010. Ellie Whitney, Sharon Rady Rolfes, 11e. Thompson Wadsworth.
2.	Nutritional Sciences- From Fundamentals to Food.2013. Michelle McGuire, Kathy A. Beerman, 2nd e. Thompson Wadsworth.
3.	Yasmine Motarjemi, Huub Lelieveld, Food Safety Management - A Practical Guide for the Food Industry (2014), 1st Edition, Academic Press, London, UK

Mode of evaluation:			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

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Course code	Course Title	L	T	P	J	C
BIT 1027	Introduction to Research Methods	2	0	0	4	3
Pre-requisite	NIL	Syllabus version				
		2. 1				

Course Objectives:

1.To impart skills in developing research topic
2.To adopt suitable experimental design for research
3.To analyze the data and arrive at valid conclusion
4. To compile and present research findings.

Expected Course Outcome:

1. Develop a research concept and identify the type of research
2. Design experiments statistically.
3. Evaluate and collect the data scientifically.
4. Analyze the data and arrive at scientific conclusion.
5. Perceive, present or publish the study orally or in writing to scientific community.
6. Adapt the ethical practices in research and publication.

Student Learning Outcomes (SLO): 7,10,14

Module:1	Research definition and concept	**3 hours**

Research Definition – Classification of Research - Types of research – Survey, historical, philosophical and experimental approach. Case studies & statistical method.

Module:2	**Variables and Data**	**3 hours**

Data types - Qualitative and quantitative data – variables types, identification of key variables- relationship among variables – correlation and regression. Sources of data – collection & organization. Sampling and sampling techniques.

Module:3	**Research process**	**4 hours**

Developing a research topic from a practical problem. Search engines and software tools for searching, retrieval and organization of literature & data. Evolving Hypothesis and testing.

Module:4	**Experimental Designs**	**5 hours**

Meaning of Research Design, Need for Research Design, Basic Principles of Experimental Designs –Replication, blocking & randomization. Randomized Block Designs - Fractional factorial & screening designs – Response Surface designs. Use of software for experimental design.

Module:5	**Data Analysis**	**5 hours**

Comparing means: Z, “t’ and Chi square tests. Analysis of variance: One way, Two way analysis, LSD, DMRT. Statistical software for analysis of experiments – interpretation of statistical values. Presentation of data – tables, graphs and illustrations.

Module:6	**Scientific publications**	**5 hours**
Common scientific styles & Description. Types of publications – Dissertation/ Journals/ Books/Patents. Assessment of publications – Measurement of Quality of publication - H-index/ Impact factor / Citations Indices. Seminars and Conferences – preparation of posters and presentations. Using scientific word processors and illustration software.		
Module:7	**Ethics in research and publication**	**3 hours**
Ethics in research. Deceptive and covert Research. Ethical Issues in Writing and Publishing – Plagiarism, Falsification/ Fabrication, duplicate & salami publications, authorship issues and conflict of interests.		
Module:8	**Contemporary issues:**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Christensen, L.B., Johnson, R.B., Turner, L.A. 2014. Research Methods, Design, and Analysis. Pearson Education Ltd., Boston.
Reference Books	
1.	Bhattacherjee, A. 2012. Social Science Research: Principles, Methods, and Practices. Published under Creative Commons Attribution-NonCommercial-ShareAlike.

Mode of evaluation:			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

Course code	Course Title	L	T	P	J	C
BIT 1028	Bio-inspired design	2	0	0	4	3
Pre-requisite	NIL	Syllabus version				
		3.2				

Course Objectives:

1. Elaborate upon the list and interpret modern engineering challenges
2. Adapt, combine solutions (taken from the living world) and apply Nature's lessons for solving engineering-related design and product-oriented problems
3. Illustrate the extensive scope of bioinspired design

Expected Course Outcome:

1. Elaborate the Biological world with a novel perspective
2. Compare the biological structures and their hierarchy
3. Distinguish the relationships between biological structure and functional correlates (including mechanisms)
4. Evaluate the importance of biological periodic designs
5. Determine the biological variability and regeneration potentials
6. Discuss the state-of-the-art in terms of Various biomimetic practices and product development and extend/translate this biomimetic theoretical knowledge for real world problem solving

Student Learning Outcomes (SLO):	2,4

Module:1	Nature as a source for inspiration of innovation	5 hours

Overview of biomimetics, definitions, scope and approach. Examples: The Lotus effect, The Mosquito needle and product inspired from them

Module:2	Biological Materials in engineering mechanism	5 hours

Structure – Function –Mechanics: The mollusc shell, Spider silk, Gecko, Muscle-inspired actuation.

Module:3	Defense and attack mechanism in biology	5 hours

Acoustics, anti-lethal device, Electrical, entangler, projectile, camouflagy

Module:4	Bio mimicry of Biological Optical devices	6 hours

Biological Reflectors, and structural colors, Color altering, Visions like- Color vision, night vision, 360 vision

Module:5	Self-regeneration	3 hours

Automaton concept, kinematic machines, Electro-mechanical self-reproduction, self assembly, RepRap type rapid prototyping machine

Module:6	Multifunctional Composites	2 hours

Mimicking natures' materials and processes for multifunctional materials			
Module:7	**Developing biomimetic-bio inspired product BioTRIZ**		**2 hours**
Potential challenges and Technical realization of Biomimetics e.g Self healing membranes, Light weight structures, Bio-TRIZ and its applications			
Module:8	**Contemporary issues**		**2 hours**
Lecture by Industrial Expert			
	Total Lecture hours:	**30 hours**	
Text Book(s)			
1.	Biomimetics: Nature-Based Innovation By Yoseph Bar-Cohen, CRC Press, 2012		
Reference Books			
1.	Handbook of Biomimetics and Bioinspiration : Biologically-Driven Engineering of Materials, Processes, Devices, and Systems (In 3 Volumes) Edited by: Esmaiel Jabbari, Deok-Ho Kim, Luke P Lee, Amir Ghaemmaghami, Ali Khademhosseini, Scientific Series in Nanoscience and Nanotechnology: Volumes 9, 2014		
Mode of evaluation:			
Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	23-08-2017

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Management Course Basket

Course code	Course title	L	T	P	J	C
MGT1002	Principles of Management	2	0	0	4	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives:

To develop the ability to

1. Understand the basic concepts of Management
2. Enable the students to study the evolution of Management.
3. Learn the application of the principles in an organization.

Expected Course Outcome:

On the completion of this course the student will be able to:

1. Infer fundamental terminology and functions of management
2. Understand theoretical foundations of management
3. Visualize case situations in each of the functions of management
4. Identify and apply appropriate management techniques for managing contemporary organizations
5. Understanding of the skills, abilities, and tools needed to obtain a job on a management track in an organization of their choice.
6. Apply and develop solution for real world corporate managerial problems

Student Learning Outcomes (SLO):	2,3,4, 5, 10,11, 12,19

Module:1	Introduction	4 Hours

Definition, nature, functions, levels of management, Types of managers, Managerial roles, managerial skills and competencies, Social responsibility of managers

Module:2	Development of Management Thought	4 Hours

Classical, neo-classical, behavioral, systems and contingency approaches.

Module:3	Planning	4 Hours

Essentials of Planning- Types, Steps, Objectives of Planning, Setting objectives- strategies, policies- planning premises – strategic planning process- decision making – nature and process

Module:4	Organizing	4 Hours

Concept, nature, process and significance, Principles of an organization, Span of Control, Depart mentation, Types of an organization, Authority- Responsibility, Delegation and Decentralization, Formal and Informal Organization.Controlling

Module:5	Staffing Definition	4 Hours

Recruitment, Selection, Training, Promotion, Transfers and Demotion

Directing: Meaning, Principles of Direction; Elements of Direction.		
Module:6	**Motivating**	**4 Hours**
Motivation concept, techniques to increase motivation. Leading as a function of management, Leadership traits, Leadership styles **Coordinating:** Meaning, Features and Coordination, Principles of Coordination.		
Module:7	**Controlling**	**4 Hours**
Nature and Scope of control; Types of Control; Control process; Control Techniques – traditional and modern; Effective Control System. **Decision Making Process**: Meaning, Decision Making Process.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**30 hours**

Text Book(s)	
1.	Stoner A. F. James. Freeman R Edward, Gilbert R. Daniel (2009) , Management , 6th edition, Pearson Education.
Reference Books	
1.	Prasad L.M. (2014), Principles and Practice of Management, 8th Edition, Sultan Chand & Sons
2	Heniz Weihrich, Mark Cannice, Harold Koontz (2013), Management: A Global, Innovative, and Entrepreneurial Perspective , McGraw Hill Education.
3	R B Rudani (2013) , Principles o f Management , McGraw Hill Education
4	Gupta C. B. (2013) , Management– Theory and Practice , 16 th Edition, Sultan Chand & Sons 5 . P C Tripathi, P N Reddy (2012) , Principles of Management , McGraw Hill Education
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

Project		
1.	Project	60 hours
	Total Project	**60 hours**

Recommended by Board of Studies	08-06-2015		
Approved by Academic Council	No. 37	Date	16-06-2015

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Course code	Course title	L	T	P	J	C
MGT1010	Total Quality Management	2	1	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.1				

Course Objectives: To develop the ability to

1. Learn the concepts of quality and quality management
2. Apply and improve process capability using total quality management principles
3. Understanding the need and importance of quality assurance and certification

Expected Course Outcome: On the completion of this course the student will be able to:

1. Know and understand the basic principles of quality, evolution of quality concepts.
2. Understanding the significance of Quality works and apply them in the current scenario.
3. Know statistical tools required to do scientific analysis and improvement of business.
4. Apply and evaluate quality tools to solve real time problems.
5. Know business models and be able to assess organizational performance.
6. Confirm to quality standards and implementing QMS in business organisation

Student Learning Outcomes (SLO): 1,2,4,6,7,9,10,14,18

Module:1	Introduction	5 Hours

Concept of Quality and Quality Management; Determinants of quality of product & service; Quality vs. Reliability ; Philosophies of Quality Gurus; Juran's Quality Triology; strategic Impact of Quality management on Business Performance; Quality statements – vision, mission, Policy; SMART goal setting;

Module:2	Quality Cost	4 Hours

Juran's concept of quality cost; components of Quality Cost; Crosby's concept of „quality is free; Quality-Cost optimization; Quality Index; Quality-Productivity Ratio; Quality Planning

Module:3	Quality Control	7 Hours

Statistical Quality Control – Inspection, Sampling, Sample Size, Sampling Plan, AQL, OC curve, Producer Risk, Consumer Risk, AOQ, AOQL, Control Charts & Control Limits – X, R & S charts and their application; causes of variations – Assignable & Random; Runs-Test, Chart-Sensitivity Test and Run-Sum Test; Normal-Distribution curve and concept of Six Sigma;

Module:4	Process Capability	6 Hours

Concept, nature, process and significance, Principles of an organization, Span of Control, Depart mentation, Types of an organization, Authority- Responsibility, Delegation and Decentralization, Formal and Informal Organization.Controlling

Module:5	**Total Quality Management**	**5 Hours**
Recruitment, Selection, Training, Promotion, Transfers and Demotion **Directing:** Meaning, Principles of Direction; Elements of Direction.		
Module:6	**Tools & Techniques of TQM**	**7 Hours**
Motivation concept, techniques to increase motivation. Leading as a function of management, Leadership traits, Leadership styles **Coordinating:** Meaning, Features and Coordination, Principles of Coordination.		
Module:7	**QMS**	**7 Hours**
Nature and Scope of control; Types of Control; Control process; Control Techniques – traditional and modern; Effective Control System. **Decision Making Process**: Meaning, Decision Making Process.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)	
1.	L. Suganthi & Dr. Anand Samuel (2004), Total Quality Management – Prentice Hall, Publications.
Reference Books	
1.	Rose J.E. – "Total Quality Management" 1997, S. Chand & Co.,
2	William J. Kolarik, (1995), "Creating Quality", McGraw Hill, Inc, NY.
3	Jill A. Swift, Joel E. Ross and Vincent K. Omachonu, (1998), "Principles of Total Quality", St. Lucie Press, US.
4	Samuel. K.H, (2002), "TQM - An Integrated Approach", Kogan Page India Pvt Ltd
5	John Bank .J.E., (1993), "Total Quality Management", Prentice Hall, India.
6	Dale.H. Besterfield et al (2005), "Total Quality Management", 3rd Edition, Pearson Education Asia.
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	
Tutorial	
1. Tutorial	15 hours

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Course code	Course title	L	T	P	J	C
MGT1014	Supply Chain Management	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Provide the an overview of Supply Chain concepts
2. Coverage of supply chain and network models
3. Evaluation methods comparison of transportation modal options

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand Supply Chain processes
2. Ability to identify the drivers of supply chain and logistics
3. Differentiate different network models and influencing factors
4. Comprehend transport modals and performance indicators
5. Understand impacts of uncertainties in Supply Chain inventories

Student Learning Outcomes (SLO):	2,5, 7,9,14,18

Module:1	Introduction	6 Hours

Understanding the supply chain-What is a supply chain-historical perspective-Objective of a supply chain-The importance of supply chain decisions, Decision phases in a supply chain-process view of a supply chains.

Module:2	Supply Chain Performance	6 Hours

Competitive and supply chain strategies -achieving strategic fit - expanding strategic Scope - obstacles to achieving strategic fit. Supply chain drivers and metrics - impellers of supply chain - drivers of supply chain-drivers of supply chain performance - framework for structuring drivers.

Module:3	Designing the Supply Chain Network	6 Hours

The role of distribution in the supply chain- factor s influencing distribution network design- design opt ions for a distribution network - distribution networks in practice – the role of network design in the supply chain – factors influences network design decisions - framework for network design decision.

Module:4	Planning Demand and Supply	6 Hours

The role of forecasting in a supply chain-characteristics of forecasts –components of forecasts and forecasts methods -basic approach to demand forecasting- time series forecasting methods

Module:5	Planning & Managing Inventories in a Supply Chain	6 Hours

The role of cycle inventory in a supply chain-estimating cycle inventory- related costs in practice-

economies of scale to exploit fixed costs -economies of scale to exploit quantity discounts.		
Module:6	**Managing uncertainty in a supply chain**	**6 Hours**
Safety inventory- the role of safety inventory in a supply chain determining appropriate level of safety inventory- impact of supply uncertainty on safety inventory- impact of aggregation on safety inventory.		
Module:7	**Designing and Planning Transportation Networks**	**6 Hours**
Transportation in a supply chain- the role of Transportation in a supply chain-mode of Transportation and their performance characteristics – Transportation infrastructure and polices - design opt ions for a Transportation network- trade-offs in Transportation design- tailored Transportation		
Module:8	**Contemporary issues:**	**3 Hours**
	Total Lecture	**45 hours**

Text Book(s)	
1.	Supply Chain Management – Strategy, Planning and Operation by Sunil Chopra and Peter Meindl Pearson / PHI, 4th Edition, 2010
Reference Books	
1.	Supply Chain Management by Janat Shah Pearson Publication 2008.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	08-06-2015		
Approved by Academic Council	No. 37	Date	16-06-2015

Course code	Course title	L	T	P	J	C
MGT1016	Intellectual Property Rights	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Generate need and importance of intellectual property rights
2. Provide knowledge that would help in developing IPR strategy
3. Instill legality related to IPR violation and necessity of protection

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand the fundamental aspects of intellectual property rights
2. Gain an in-depth understanding of global intellectual property rights
3. Understand the application of Indian Patent Laws
4. Know the implications of copyright, trademark etc.
5. Acclimatized with the documentation and legal frame work concerning Intellectual Property Rights.
6. Acquire knowledge about an industrial design and its pattern protection.

Student Learning Outcomes (SLO):	2,11,14

Module:1	Introduction	7 Hours

Introduction and the need for intellectual property right (IPR)- IPR in India – Genesis and Development- IPR in abroad – Some important examples of IPR

Module:2	IPR Toolkit	10 Hours

IPR Toolkit – Patents – Global Patent Ownership – Patent Global Index – Patenting Process – Inventor's Homework prior to discussion with Patent Attorney – Patenting Process in US PTO – JPO – EPO – PCT – Issues relating to turmeric, basmati, neem – Inventions not patentable – Rights of Patentee – current developments – Infringement of Patents.

Module:3	Trademarks	5 Hours

Trademarks – Essentials of a Trademark – Reasons for illegal protection – Registerability – Procedure for registration – Infringement of Registered Trademarks, Assignments of Trade Marks.

Module:4	Copy Rights	5 Hours

Copy Rights – Introduction - Characteristics – Items covered under copy right – Rights of Copy right owner – Infringement - Remedies for Infringement.

Module:5	Industrial design	10 Hours

Industrial design – Essentials necessary for a design – Eligibility for registration – Infringement Geographical Indications – Eligibility for Registration – Infringement Protection of Plant varieties and farmer's rights – Rights of plant breeders and farmers and agreement of TRIPS UPOV international conventions – refresher – registerability of plant varieties – effect of registration – infringement thereof Trade Secrets – Essentials of a Trade Secret – What can be a Trade Secret.		
Module:6	**IPR**	**8 Hours**
International Approach – Treaties in IPR & Conventions – Infringements – Remedies – Emerging issues in IPR		
	Total Lecture	**45 hours**

Text Book(s)	
1.	Prabuddha Ganguli, (2010), Intellectual Property Rights - Unleashing Knowledge Economy, Tata McGraw Hill
Reference Books	
1.	Ahuja V K (2010), Law Related to Intellectual Property Rights, 1st edition, Lexis Nexis Butterworths Wadhwa Nagpur
2	Tamali Sen Gupta (2011), Intellectual Property Law in India, Kluwer Law International 3.B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical
3	Indications; Universal law Publishing Pvt. Ltd., India 2010
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

Recommended by Board of Studies	08-06-2015		
Approved by Academic Council	No. 37	Date	16-06-2015

Course code	Course title	L	T	P	J	C
MGT1017	Business Regulatory Framework for Start-ups	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Provide orientation of various forms of companies and regulatory implications.
2. Provide legal and regulatory knowledge on conducting business in India.
3. Develop knowledge and expertise for running legalized startup business

Expected Course Outcome: On the completion of this course the student will be able to:

1. Obtain conceptual and contemporary issues in the area of business regulatory framework
2. Identify suitable forms of companies and process for startup registration
3. Explore various funding sources
4. Acquire knowledge on legal and regulatory frame work
5. Familiarize with acts pertaining to SEBI, FEMA and consumer protection

Student Learning Outcomes (SLO):	2,11

Module:1	Introduction	9 Hours

Definiion, Meaning and Features of a Company. - Promotion and Procedure for incorporation of a company - Classification of Companies. - Conversion of Private Company into Public and Public Company to Private. - Share Capital and Classification of Shares - Winding Up of a Company

Module:2	Outlines of Partnership Act	8 Hours

Partnership: Definition - Essential Features of Partnership - Partner: Classification - Dissolution of Partnership and Dissolution of Partnership Firm - Rights, Duties and Liabilities of Partners - Limited Liability Partnership - Features

Module:3	SEBI (Venture Capital) Regulations 1996	8 Hours

Registration of Venture Capital Funds - Eligibility Criteria - Conditions and Restrictions on Investment - Minimum investment in a Venture Capital Fund - General Obligations and Responsibilities.

Module:4	Micro, Small and Medium Enterprises Development Act	7 Hours

History - Classification of Enterprises - Registration of Enterprises - Benefits of Registering MSME - Consequences of Non-Registration of MSME - Constitution of National Board of Micro, Small and Medium Enterprises - Powers and Functions of the Board

Module:5	**Outlines of Foreign Exchange Management Act**	**7 Hours**
Foreign Exchange Regulation Act, 1973 (FERA) in Brief - Foreign Exchange Management Act, 1999 - Introduction. - Regulation and Management of Foreign Exchange. - Realization and Repatriation of Foreign Exchange. - Exemptions from Realization and Repatriation		
Module:7	**Outlines of The Consumer Protection Act**	**6 Hours**
Aims and Objectives of the Act - Consumer - Definition - Consumer Disputes - Consumer Disputes Redressal Agencies and Jurisdiction - Rights of Consumers under the Act.		
	Total Lecture	**45 hours**

Text Book(s)	
1.	Sankaran, Dr. S., "Business Regulatory Frame Work" Margham Publications, Chennai, 2015.
Reference Books	
1.	Bulchandani, Dr. K.R, " Business Environment and Law" Himalaya Publishing House, Mumbai, 2013
2.	The Micro, small and Medium Enterprises Development Act, 2006.
3.	SEBI (Venture Capital Funds) Regulations, 1996

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	08-06-2015		
Approved by Academic Council	No. 37	Date	16-06-2015

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Course code	Course title	L	T	P	J	C
MGT1018	Consumer Behavior	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Study the dynamics between consumer behavior and market
2. Understand how new technologies are enabling marketers to better satisfy the needs and wants of the consumers.
3. Critically evaluate the factors influencing the buying behaviors of individuals

Expected Course Outcome: On the completion of this course the student will be able to:

1. Associate with the key concepts and theories of consumer behavior
2. Recognize psychological theories relevant for understanding consumer behavior
3. Understand how the design of a product should be done by taking all the factors influencing the behavior of individuals.
4. Understand the relevance of Market study and consumer behavior for a successful product development and finally for consumer satisfaction.

   Understand the important concepts and theories in developing a feasible product and a viable marketing strategies

Student Learning Outcomes (SLO):	1,3,4,5

Module:1	Introduction	5 Hours

Understanding what is consumer behavior and Scope and Relevance of consumer behavior Studies, Stimulus-Response model of Consumer Behavior.

Module:2	Basic Marketing concepts	5 Hours

Market Segmentation and Position ing: Market Segment ation - Basis for Segmentation – positioning strategies ; Customer Satisfaction, value , retention

Module:3	Marketing and Environmental Influences	5 Hours

Product, price, place and promotional influence on consumer behaviour. Political , economic, socio-cultural, technological, demographic and natural factors

Module:4	Individual Determinants of Consumer Behavior	10 Hours

Motivation, Attention, Perception and Consumer Imagery; Learning and Memory; Personality and Self Concept; Consumer Attitudes – Formation and Change; Consumer Values and Life styles.

Module:5	**External Determinants of Consumer Behavior**	**10 Hours**
Influence of Culture and Subculture; - Opinion Ladership, Social Class; Reference Groups and Family Influences		
Module:6	**Models of Consumer Behavior**	**10 Hours**
The Howard Sheth model of Buying behavior - The Nicosia model – The Engel, Blackwell and Miniard (EBM) model; Diffusion of innovation, online consumer behavior, Consumer Behavior Analysis and Marketing Strategy:		
	Total Lecture	**45 hours**

Text Book(s)	
1.	Majumdar, Ramanuj (2010), Consumer Behaviour: Insights from Indian Market, PHI Learning Pvt. Ltd
Reference Books	
1.	Solomon, Michael R. (2011), Consumer Behaviour: Buying, Having and Being, PHI Learning Pvt. Ltd.
2.	Schiffman L.G. and Kanuk L.L. (2010), Consumer Behaviour, 10th Edition, Pearson Education
3.	Hawkins. D. I. & Best R.J and Coney, K.A. and Mookerjee, A, (2010) Consumer Behaviour- Building Marketing Strategy. Tata McGraw Hill
4.	Assel Henry, (2006), Consumer Behaviour, Cengage Learning, New Delhi.
5.	Loudon, David L.and Della Bitta, J.(2002) Consumer Behaviour, 4th Edition, Tata McGraw Hill.
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

Recommended by Board of Studies	08-06-2015		
Approved by Academic Council	No. 37	Date	16-06-2015

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Course code	Course title	L	T	P	J	C
MGT1019	Service Marketing	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Demonstrate ability in evaluating service designs
2. Achieve skills in managing and delivering quality services
3. Develop an understanding of the 'state of the art' service management thinking.

Expected Course Outcome: On the completion of this course the student will be able to:

1. Provide a theoretical and practical basis for assessing service performance
2. Explain and apply key services frameworks like 7P's of marketing
3. Explain roll of technologies in new age services marking
4. Demonstrate skills set of using SERVQUAL tools
5. Identify critical issues in service design and develop service delivery models
   Classify important issues in service delivery processes

Student Learning Outcomes (SLO): 1,2,3,4,5,6

Module:1	Introduction and overview	5 Hours

Service Definitions - Role of Services in an Economy and its reasons for growth in India and global - Characteristics of services - Classifications of services.

Module:2	Traditional Marketing	5 Hours

Consumer Behaviour and Application of Traditional Marketing Programmes in Service. Consumer behaviour in Service Encounter Services and Positioning

Module:3	Traditional 4Ps	8 Hours

Creating the Service Product – Integrated Services Marketing Communications – Pricing of Services – Place: Distributing service

Module:4	Services Marketing	9 Hours

Expanded Services Marketing Programmes - People, process and physical evidence : People – Employees' Roles in Service Delivery and Customers' Roles in Service Delivery - Physical Evidence – Types of servicescape, Roles, Effects and Guidlines - Process – Servics Blueprinting

Module:5	SERVQUAL	8 Hours

Customer Expectation and customer perception - The GAP Model - Measuring Service Quality: SERVQUAL and Walk through Audit – Quality Service by Design: Tagu

chi Method, Poka-Yoke, Quality Functional Deployment - Achieving Service Quality: Cost of quality and Service Recovery		
Module:6	**Demand and Capacity**	**10 Hours**
Managing Demand and Capacity: Strategies for Managing Demand and Strategies for Managing Capacity – Yield Management. Managing Waiting Lines – Capacity Planning and Queuing Models		
	Total Lecture	**45 hours**

Text Book(s)	
1.	Christopher Lovelock, Jayanta Chatterjee and Jochen Wirtz (2011), Services Marketing, 7th Edition, Pearson Education.
Reference Books	
1.	Valarie A. Zeithaml, Mary Jo Bitner, Dwayne D. Gremler (2013),Services Marketing, 6th edition, McGraw- Hill.
2	James A. Fitzsimmons and Monaj. Filzsimmons,(2004), Services M
3	Douglas Hoftman and John G. Bateson, (2002), Essentials of Services Marketing : Concepts, Strategy and Cases; 2 nd Edition, Thomson – South western, Singapore.
4	Jha S.M.,(2000), Services Marketing, Himalaya Publishing House, Bangalore
5	Manfred Bruhn, (2005), Services Marketing: Managing the Service Value Chain, Pearson Education.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	08-06-2015		
Approved by Academic Council	N0. 37	Date	16-06-2015

Course code	Course title	L	T	P	J	C
MGT1020	Marketing Analytics	2	0	2	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Demonstrate skill and knowledge in Marketing analytics
2. Pilot product and market segmentation strategies
3. Infer the customer value analysis and customer analytics

Expected Course Outcome: On the completion of this course the student will be able to:

1. Handle basic business analytics
2. Demonstrate Marketing research tools
3. Apply tools for market segmentation and positioning
4. Contribute for new product introduction decisions
5. Workout customer values analysis
6. Evaluate market by customer analysis

Student Learning Outcomes (SLO):	1,2,3,4,5,6

Module:1	Marketing Analytics	5 Hours

Basics of Marketing and Marketing Management – Analytics and Analysis – Basiss of business analytics – Why marketing analytics – Marketing decision models and marketing response models.

Module:2	Marketing Research Tools	6 Hours

Principal Component Analysis – Multidimensional Scaling – Discriminant Analysis – One way and Two way Analysis of Variance – Forecasting Tools: Simple Linear Regression – Multiple Regression – Moving Average Forecasting Methods

Module:3	Tools for Segmentation and Positioning	6 Hours

The segmentation process – Tools for segmentation: Factor analysis, Clustering methods, Regression Analysis – Differentiation and Positioning: Analytical tools for differentiation and positioning – Perceptual Maps – Models for Strategic marketing decision making

Module:4	Tools for New Product Decision	8 Hours

Conjoint Analysis for Product Design – Forecasting Sales of New products –

Advertising: Measuring the effectiveness of Advertising – Media Selection models – Channel Decision: Marketing Channel Decision models and tools – Pricing: Price Bundling – Price Skimming and Sales				
Module:5	**Customer Analytics**			**5 Hours**
Tools for analyzing customer want: Logit and Probit Regression – Customer Value: Customer Lifetime Value Analysis – Monte Carlo Simulation and Marketing Decision making.				
	Total Lecture			**30 hours**
Text Book(s)				
1.	Wayne L. Winstor (2014), Marketing Analytics: Data Driven Techniques with Microsoft Excel, Wiley India Pvt. Ltd., New Delhi, India			
Reference Books				
1.	Stephen Sorger (2013), Marketing Analytics: Strategic Models and Metrics, Atlantic Publishers and Distributors, USA.			
2	Paul W.Farris et al (2010), Marketing Metrics, Pearson Education,			
3	Gary L. Lilien and Arvind Rangaswamy (2004), Marketing Engineering: Computer Assisted Marketing Analysis and Planning, Trofford Publishing, USA.			
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar				
List of Challenging Experiments (Indicative)				
1.	Experiment using SPSS/SAS/R Programming in the areas of Marketing Research, Segmentation and Positioning; marketing programming and customer Analytics			30 hours
			Total Laboratory	**30 hours**
Recommended by Board of Studies	08-06-2015			
Approved by Academic Council	No. 37	Date	16-06-2015	

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Course code	Course title	L	T	P	J	C
MGT1021	Digital and Social Media Marketing	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Know the impact of digital and social media on marking
2. Explore and use digital and social media for effective marking
3. Design and develop tools and metrics

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand the architecture & models of online marketing practices
2. Gain idea on Web-based consumer decision making process
3. Knowledge on challenges faced by millennial marketers
4. Awareness on web-based tools that helps the customers in product and related search
5. Provide information on online marketing & customer management practices
6. To know the managerial tools for digital and social media marketing

Student Learning Outcomes (SLO):	1,2,3,4,5,6

Module:1	Introduction	6 Hours

The digital and social media ecosystem- the challenges- rewriting of traditional operational space- the role of digital and social marketing communications in contemporary world.- the principles- tools available with the managers.

Module:2	The digital platform	6 Hours

The impacts of digital environment on information procurement and consumption- the reworking of decision making process (DMP) and the decision making unit (DMU) under the contemporary technological settings. Digital communication mix- its impacts- assessment tools – models..

Module:3	The social media platform	9 Hours

Consumer Tribes and Communities, Users and Cocreation of Value, Brand and Anthropomorphic Marketing, Understanding Platforms in Social Media Marketing, Understanding Content in Social Media Marketing, Electronic Word of Mouth (eWOM),Understanding Context in Social Media Marketing, Measurement, Metrics and Analytics, Cross Cultural Aspects and Implications, Privacy

Module:4	Social media and networking	6 Hours

Social media and Web 2.0- participatory nature- collaboration aspects- development of new social media in the last decade- Distinctions of Social Communities- Networking & Sharing effects- Distinctions with traditional marketing.

Module:5	**Understanding the digital consumer**	**6 Hours**
Their character-their necessities and priorities- interface with marketing field- distinguishing between hype, noise, reputation management, and compulsion. Technology vs. Communication- Five mind-set shifts		
Module:6	**Advertising and Brand Building with SMM**	**6 Hours**
Brand strategies on social media-Best marketing practices for paid and unpaid social media - B2B marketing and social media.		
Module:7	**Issues in DM & SMM**	**6 Hours**
Ethical and measurement issues in Digital and social media marketing. Social Media Analytics and Monitoring- types of data to be collated and used- distinguishing between mere reporting and genuine analysis- overview of frameworks- Awareness, attention, engagement and influence in SMM-linear/nonlinear approaches to audience interaction- categorizing social media metrics- Use of Google Analytics.		
	Total Lecture	**45 hours**

Text Book(s)	
1.	Lon Safko (2012) The Fusion Marketing Bible: Fuse Traditional Media, Social Media, & Digital Media to Maximize Marketing, McGraw-Hill Professional
Reference Books	
1.	Smith, N. (2013) Successful Social Media Marketing in a Week, Teach Yourself
2.	Macarthy, A (2013) 500 Social Media Marketing Tips, Create Space Independent Publishing.
3.	Barker, Barkar, Bormann & Neher (2013) Social Media Marketing : A Strategic Approach, Cengage Learning
4.	Allen M (2014) Social Media Marketing: Beginner's Guide To Social Media Marketing, Amazon Kindle
5.	Singh, S. , Diamond S. (2012) Social Media Marketing for Dummies, Wiley India Private Limited.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	08-06-2015		
Approved by Academic Council	No. 37	Date	16-06-2015

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Course code	Course title	L	T	P	J	C
MGT1023	Fundamentals of Human Resource Management	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Provide a thorough understanding of the concepts of Human Resource Management
2. Understand the contribution of Human Resources to organizational effectiveness
3. Apply the various skills learnt in the course to organizational situations

Expected Course Outcome: On the completion of this course the student will be able to:

1. Obtain conceptual level knowledge in HRM
2. Explore various human resource skills required in an organization
3. Apply various skills, procedures and techniques in managing human resources
4. Understand the mandatory labor laws governing human resources
5. Apply various concepts to enhance personal and organizational effectiveness
6. Make use of HRM tools and techniques to achieve competitiveness

Student Learning Outcomes (SLO):	1,2,3,6,8,9, 10,19

Module:1	Introduction	4 Hours

Evolution and Development of Human Resource Management – Objectives and Functions – HRM in the New Millennium

Module:2	Acquisition and Absorption I	3 Hours

Human Resource Planning(HRP) – Need and Importance of HRP in Organizations – HRP Process – Job Analysis – Factors affecting Job Design

Module:3	Acquisition and Absorption II	3 Hours

Recruitment – Process – Sources - Selection – Need for Scientific selection – Selection Procedure – Placement, Orientation and Socialization of Personnel

Module:4	Human Resource Development – I	3 Hours

Employee Training – Importance – Training Methods – Process of Employee Training

Module:5	Human Resource Development – II	6 Hours

Executive Development – Importance – Methods - Career Planning and Development - Basics of Knowledge Management – Knowledge Sharing Culture

Performance Management: Performance Appraisal – Process – Methods - Job Evaluation – Process

Module:6	Compensation and Incentives	6 Hours

Components of Remuneration – Importance of an Ideal Remuneration System-Incentives and Benefits. **Maintenance- I:** Motivation Perspectives – Welfare Activities - Need for a Safe and Healthy Environment		
Module:7	**Maintenance- II**	**3 Hours**
Managing Separations - Promotion Policies - Nature of Industrial Relations – Resolving Disputes – Concept of Collective Bargaining and Industrial Discipline		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)	
1.	Aswathappa K (2010), Human Resource Management: Text and Cases, 6th Edition, Tata McGraw-Hill.
Reference Books	
1.	Prasad L M (2005), Human Resource Management, Sultan Chand and Sons.
2	Khanka S S (2008), Human Resource Management, S.Chand Publications.
3	Kenton Barbara and Yarnall Jane (2010), HR – The Business Partner, 2nd Edition, Elsevier Butterworth-Heinemann.
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

Project		
1.	Project	60 hours
	Total Projecrt	**60 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-06-2016

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Course code	Course title	L	T	P	J	C
MGT1024	Organizational Behaviour	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Familiarize the basic concepts of management and organizational behavior.
2. Understand, evaluate and effectively manage individual, group and structure behaviour in an organization.
3. Explore organizational behaviour in creating a sustainable competitive advantages

Expected Course Outcome: On the completion of this course the student will be able to:

1. Examine different aspects of behavior, attitude, perception and personality.
2. Explore concepts in organizational behavior.
3. Describe the various dimensions of motivation.
4. Measure and monitor different aspects of emotion and stress.
5. Explain the various elements of group and team.
6. Analyze the different dimensions of organizational structure and culture.

Student Learning Outcomes (SLO):	1,2,3,4,6,7,8,9,10,11,12,13,14

Module:1	6 Hours

Understanding Organizational Behaviour, Understanding your learning style, tools of OB Rresearch, Demographic and Cultural Diversity

Module:2	6 Hours

Perception, Individual Attitudes and Behaviour: Individual differences, Values and Personality, Percepton, Work attitudes and Work behaviours

Module:3	7 Hours

Motivation and Designing a Motivating environment : Theories of motivation – Need-based and Proces-based theories, Motivating Employees through Job Design, Goal setting, Performance appraials and Performance incentives

Module:4	6 Hours

Managing stress and Emotions : Meaning of Stress, avoiding and Managing stress, Emotions at work

Module:5	6 Hours

Executive Development – Importance – Methods - Career Planning and Development - Basics of Knowledge Management –Knowledge Sharing Culture

Performance Management: Performance Appraisal – Process – Methods - Job Evaluation –

Process		
Module:6		**6 Hours**
Groups , teams , Conflict and Negotiations: Gr oup Dynamics , Team Design chara cteristics, management of Teams, barriers to effective teams, Conflict – its causes and consequences		
Module:7		**6 Hours**
Organi zat ion stru cture a nd Orga ni za tion al cul tur e: Diff er ent types of Or gani zat ional structure, Understanding Organizational culture, Organizational change		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)	
1.	Stephen Robbins and Timothy Judge(2013), Organizational Behavior, 15th editi on, Pearson Education
Reference Books	
1.	Udai Pareek (2004), organization Behaviour, Oxford Publishing
2	Organizational Behavior(2008) 4th edition by McShane, Van Glinow & Radha Sharma
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	
Project	
1.	Project — 60 hours
	Total Project — 60 hours

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1025	Foundations of Management and Organizational Behaviour	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Understand the basic principles of Management and Organizational Behaviour
2. Analyses organizational situations based on the concepts .
3. Know the changes and contemporary management practices.

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand the basic theoretical concepts of Management and Organizational Behavior
2. Understand and connect the concepts with contemporary issues
3. Understand real time management problems, analyses it and find solutions
4. Have cross cultural competency exhibited by working in teams
5. Develop managerial skills
6. Conduct organisation behavior

Student Learning Outcomes (SLO):	1,2,3,4

Module:1	Concept of Management	3 Hours

Management – Definition –Management Functions - Levels of Management –Management Roles – Management Skills.

Module:2	Evolution of Modern Management	3 Hours

Different Schools of Management Thoughts - Classical Approach-Fayol's principles, – Neoclassical Approach – Hawthorne studies , Modern Approach

Module:3	Management Process:	6 Hours

Planning, Organising, Directing, Staffing and Controlling. Planning – Types, Steps, Objectives - Strategies: Levels, Steps , Policies , Planning Premises, Decision Making – Definition, Steps

Module:4	Organization structure	6 Hours

Organizing, Organization structure, Key element s in designing organization structure, purpose of organizing, types of departmentalization

Module:5	Organizational Behaviour	6 Hours

Concept of Organization, Organizational Behaviour – Definition – Nature – Individual behavior – Percept ion – Personality

Module:6	Motivational and Leadership Theories	5 Hours

Motivation, Definition – Classical theories and Contemporary theories of motivation		
Module:7	**Group Behaviour :**	**14 Hours**
Group Behavior – Formal and Informal Groups – Stages of Group Development , Team – Team effectiveness, Communication, Conflict, Leadership –styles **Application based:** Exercises, Case studies , & Research paper works		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)	
1.	L.M Prasad, Principles and Pract ice of Management , Sul tan Chand & Co. ,2010.
Reference Books	
1.	Koontz, Weihrich & Aryasri ,Principles of Management , 2004, Tata McGraw Hi l l
2	Stephen Robbins, Organizational Behaviour , 10 t h Edition, Prentice Hal l India Pvt . Ltd. , 2004.
3	L.M. Prasad, Organizational Behaviour , Sultan Chand & Sons, 2011, New Delhi
4	Koontz , O'Do n ell and Weihrich, Essentials of Management , 5th Edition, Tata McGraw Hill , Delhi , 2001.
5	Fred Luthans, Organisational Behaviour , Irwin 8t h Edi t ion, 1998.
6	Koontz, O'Donnell and Weihrich , Ma nagement , McGr aw Hill , London .

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Project		
1.	Project	60 hours
	Total Project	**60 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Course code	Course title	L	T	P	J	C
MGT1027	Product Design, Management Techniques and Entrepreneurship	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Development Product development
2. Understand management techniques
3. Understand entrepreneurial functions .

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand the steps in product design
2. Familiarize with the product development process
3. Calculate financial feasibility of product
4. Understand management techniques
5. Lean concepts of entrepreneurial aspects
6. Understand small business management

Student Learning Outcomes (SLO): 2,6,7,9,10

Module:1	Product Design	7 Hours

Concept generation - Product Architecture - Industrial Design Process - Management of Industrial design Process and Assessing the quality of Industrial Design - Establishing the product specification

Module:2	Product Development	8 Hours

Criteria for selection of product - Product development process - Design for Manufacture - Estimate the manufacturing cost - Reduce the support cost – Prototyping - Economics of Product development projects.

Module:3	Product Economic Feasibility	6 Hours

Elements of Economic analysis - financial models - Sensitive analysis and influence of the quantitative factors.

Module:4	Management Techniques	7 Hours

Technology Management - Scientific Management- Development of Management - Principles of Management - Functions of management – planning - organization - Directing, Staffing and

Module:5	Entrepreneurial Competence	7 Hours

Management by objective - SWOT analysis - Enterprise Resource planning and supply chain management. Concept of Entrepreneurship

Module:6		**3 Hours**
Entrepreneurship as a career - Personality Characteristic a successful Entrepreneur - Knowledge and skill requied for an Entrepreneur		
Module:7	**Management of Small Business**	**5 Hours**
Pre-feasibility study - Ownership - budgeting - project profile preparation- Feasibility Report preparation - Evaluation Criteria - Market and channel selection - Product launching - Monitoring and Evaluation of Business - Effective Management of Small business.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)	
1.	Karal, T.Ulrich, Steven.D.Eppinger, "Product Design and Development", McGraw- Hill, 2008
Reference Books	
1.	H.Koontz and Cyril O Donnell, "Essentials of management", McGraw Hill, 2010.
2	Robert.D.Hisrich, Michael P Peters, "Entrepreneurship"McGraw Hill, 2009
3	Stephen R.Rosenthal, "Effective Product Design and Development: How to cut lead time and increase customer satisfaction", McGraw-Hill Professional Publishing, 1992.
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

Project		
1.	Project	60 hours
	Total Project	**60 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Course code	Course title	L	T	P	J	C
MGT1028	Accounting and Financial Management	2	1	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Understand the working knowledge of basic accounting and finance terminology
2. Apply accounting and financial management tools and techniques in decision making

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand the basic financial decisions made by companies
2. Prepare professional accosting documents for business entities
3. Analyze and interpret the financial statements to check financial health of business.
4. Know the need and importance of Financial – Investment – Dividend decisions made by companies
5. Obtain knowledge various accounting standards
6. Demonstrate financial performance analysis, reporting and decision making for companies

Student Learning Outcomes (SLO): 1,2,4,7,9,10,18

Module:1	Basic Accounting Procedures	4 Hours

Double entry system - Classification of Accounts – Golden Rules of Accounting. Accounting Cycle: Books of original record; Journal , Ledger –Subsidiary Books - Trial Balance

Module:2	Final Accounts	4 Hours

Preparation of Final Accounts; Trading, Profit and Loss Account – Balance Sheet

Module:3	Financial Statement Analysis I	5 Hours

Analysis and interpretation of financial statements from investor and company point of view. Financial Reporting: Corporate Financial Reporting - Issues and problems with special reference to published financial statements IAS, IFRS.

Module:4	Fundamentals of Financial Management	1 Hour

Financial Management - Meaning - Scope and Objectives – Finance decisions- Financial goal: Profit maximization Vs. Wealth Maximization- Role of finance manager.

Module:5	Time Value of Money	5 Hours

Time Value of Money: Time preference for money- methods of adjusting cash flows for time value of money : Compounding Method, Discounting Method

Risk and Return: Introducing risk and return –Risk Diversification: systematic and unsystematic risk - Beta - Risk-free rate - risk premium

Sources of Finance: Introduction- Short-term Funds, Long-term Funds.

Module:6	Finance Decisions	5 Hours

Finance Decisions: Cost of Capital - significance - Calculation of cost of debt, preference capital, equity capital and retained earnings; Weighted Average Cost of Capital. Capital Structure- Determinants – Theories; Leverage: Financial and Operating Leverage. **Investment Decisions :** Nature of Investment Decisions, Investment Evaluation criteria: net present value, internal rate of return, profitability index, payback period, accounting rate of return		
Module:7	**Dividend Decisions**	**4 Hours**
Dividend Decisions : Determinants of Dividend, Forms of dividends, Issues in Dividend Policy; Walter's model, Gordon's model, M-M hypothesis **Liquidity Decisions:** Concepts of working capital- need of working capital and its determinants – Types -Working capital estimation.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**30 hours**

Text Book(s)	
1.	DhaneshK.Khatri (2012) "Financial Accounting & Analysis", Tata McGraw-Hill Publishing Limited, New Delhi.
2.	I.M. Pandey (2015), Financial Management,11th Edition,Vikas Publications
Reference Books	
1.	Gupta R. L. and Gupta V. K. , (2012) , Financial Accounting, S. Chand & Sons Publications, New Delhi .
2	Maheshwari S N and Maheshwari S K, (2009) , An Introduct ion to Accountancy, 9th Edi t ion, Vikas Publishing House.
3	Shashi K Gupta, Rk Sharma (2014), Financial Management Theory & Practice, 8th Edition, Kalyani Publishers.
4	M Y Khan, P. K Jain (2014) , Financial Management , Tata Mcgraw Hi l l .
5	Prasanna Chandra(2014) , Fundamentals of Financial Management , Tata McGraw Hill
6	James C VanHorne, John M Wachowicz (2008) , Fundamentals of FinancialManagement , 13th Edi t ion, Prent ice Hal l .
7	Stephen Ross, Randolph Westerfield, Bradford Jordan (2010), Fundamentals of Corporate Finance,Tata Mcgraw Hill.
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	
Tutorial and Project	
1.	Tutorial 15 hours
2	Project 60 hours

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1029	Financial Management	2	1	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. The objective of the course is to make a student to understand the basic finance concepts, functions and corporate governance issues faced by financial managers.
2. Achieve skills in Financial management and decision making in companies
3. Use of financial decision making as tool to corporate value addition

Expected Course Outcome: On the completion of this course the student will be able to:

1. Interpret Foundational financial management concepts
2. Understand the concept of time value of money and determine the present and future values of cash flows
3. Know the need and importance of Financial – Investment – Dividend decisions made by companies
4. Develop critical thinking leading to effective financial decisions
5. Analysis and interpreting business data and information
6. Effective financial decision making for competitive advantages

Student Learning Outcomes (SLO):	1,7,9,10,12,18

Module:1	Fundamental Concepts	3 Hours

Financial Management - Meaning – Scope and Objectives – Finance decisions- Financial goal: Profit maximization Vs. Wealth Maximization- Role of finance manager - Recent development in the domain of financial management

Module:2	Time Value of Money	5 Hours

Time preference for money- methods of adjusting cash flows for time value of money : Compounding Method, Discounting Method

Module:3	Risk and Return	4 Hours

Introducing risk and return -Risk Diversification: systematic and unsystematic risk - Beta - Risk-free rate - risk premium

Module:4	Sources of Finance	2 Hours

Introduction- Short-term Funds, Long-term Funds.

Module:5	Finance Decisions	5 Hours

Cost of Capital - significance - Calculation of cost of debt, preference capital, equity capital and retained earnings; Weighted Average Cost of Capital. Capital Structure- Determinants – Theories; Leverage: Financial and Operating Leverage.

Module:6	**Investment Decisions**	**4 Hours**
Nature of Investment Decisions, Investment Evaluation criteria: net present value, internal rate of return, profitability index, payback period, accounting rate of return		
Module:7	**Dividend Decisions**	**5 Hours**
Dividend Decisions : Determinants of Dividend, Forms of dividends, Issues in Dividend Policy; Walter's model, Gordon's model, M-M hypothesis **Liquidity Decisions:** Concepts of working capital- need of working capital and its determinants – Types -Working capital estimation.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**30 hours**

Text Book(s)	
1.	I.M. Pandey (2015), Financial Management,11th Edition,Vikas Publications
Reference Books	
1	Shashi K Gupta, Rk Sharma (2014), Financial Management Theory & Practice, 8th Edition, Kalyani Publishers.
2	M Y Khan, P. K Jain (2014) , Financial Management , Tata Mcgraw Hi l l .
3	Prasanna Chandra(2014) , Fundamentals of Financial Management , Tata McGraw Hill
4	James C VanHorne, John M Wachowicz (2008) , Fundamentals of FinancialManagement , 13th Edi t ion, Prent ice Hal l .
5	Stephen Ross, Randolph Westerfield, Bradford Jordan (2010), Fundamentals of Corporate Finance,Tata Mcgraw Hill.
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	
Project	
1.	Project 60 hours
2.	Tutorial 15 hours

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1030	Entrepreneurship Development	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Familiarize the concept and overview of entrepreneurship
2. Impart knowledge on the basics of entrepreneurial skills and competencies
3. Explore new vistas of entrepreneurship in generating innovative business ideas.

Expected Course Outcome: On the completion of this course the student will be able to:

1. Showcase the ability to identify and evaluate entrepreneurial opportunities
2. Demonstrate understanding of the entrepreneurial process and the success factors
3. Demonstrate critical thinking skills, use of tools, theories and context to solve problems
4. Demonstrate knowledge of Management functions and their integration
5. Design a Business Plan Document
6. Demonstrate professional, esponsibilities and aspire to add value to society

Student Learning Outcomes (SLO):	1,2,3,7,9,10,12,18

Module:1	Concepts of Entrepreneurship	4 Hours

Meaning - Entrepreneur, Manager, Entrepreneur & Entrepreneurship; Conceptual model of Entrepreneurship; Entrepreneurial role / functions, Qualities/ traits of Entrepreneurs; Entrepreneur types; Motivational forces; Myths of Entrepreneurship; Factors affecting entrepreneurship growth; Reason for business failures, causes and preventive measures; Future of Entrepreneurship in India.

Module:2	Entrepreneurial Environment	2 Hours

Business Environment; Role of Family and Society; Environmental helps & barriers to entrepreneurship; Entrepreneurship Development Training and Other Support Organisational Services; Central and State Government Industrial Policies and Regulations.

Module:3	Theories of entrepreneurship	6 Hours

Entrepreneurship Decision process - The Aspects of Entrepreneurial process; Identifying the opportunities, Sources for new ideas & evaluation of new idea for doing business; Idea generation tools; Creative Problem solving techniques used in entrepreneurial decision making.

Module:4	Prefeasibility Study	6 Hours

Defining the product/service offering; Criteria for Selection of Product; Customer Segment; Value Preposition; Channel and customer relationship management; Revenue Structure.

Module:5	Determine the resources required & management of the enterprise	6 Hours

Finance and Human Resource Mobilization; Operations Planning; Identifying Key partners; Growth Strategies.

Module:6	**Components of project cost**	**6 Hours**
Sources of capital; Criteria's for selecting a particular project. Feasibility report preparation		
Module:7	**Process of Business commencement**	**7 Hours**
Process of setting up of a Micro Small Medium Enterprise (MSME) – Procedures and formalities for registration of business units and its benefits; Types of ownership in Business & its merits and demerits; Government promotional measures like Incentives and subsidies & bounties for business units; Policy initiatives. **Institutional support & Preparation of Business Plan:** Central and State level Institutional support for business units. Industrial Estates & Special Economic Zones in India - Business Plan: Meaning, Objectives, Model format of business Plan		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)	
1.	Robert D Hisrich, Michael P Peters, & Dean A Shepherd, (2007) Entrepreneurship, The McGraw Hill Companies
Reference Books	
1.	Prasanna Chandra, Projects : Planning, Analysis, Selection, Financing, Implementation and Review 7th Edition
2	C.B Gupta & S. Srinivasan, Entrepreneurial Development, S. Chand & Co., Limited New Delhi. 2005
3	Donald Kuratho & Richard M Hodgetts, (2005) Entrepreneurship (Theory, Process and Practice), Thomson
4	Robert D Hisrich, Michael P Peters & Dean a Shepherd (2005) Entrepreneurship, The McGraw Hill Companies
5	Rajeev Roy (2008) Entrepreneurship, Oxford Higher Education
6	Mathew Manimala (2005), Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra, 2nd Edition.
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	
Project	
1.	Project — 60 hours
	Total Project — **60 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1031	INTERNATIONAL BUSINESS	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Learn nature, scope and structure of International Business.
2. Understand the influence of global environmental factors on international business operations.
3. Understand the geopolitical and roll and function of trade bodies

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand theoretical concepts of international business
2. Learn the significance of growing global business today and the effect of international business on India.
3. Develop strategies in the future which a manager must follow in order to survive in a competition
4. Understand world trading systems
5. Understand international capital flows
6. Familiarize with international business operations

Student Learning Outcomes (SLO):	2,4,5,11,12,13,14

Module:1	Basic Concepts and Theories of International Business:	6 Hours

Introduction to Business, Multi-national Corporations and International Business, Globalization, and the drivers to go global- Emergence of Indian Economy in Global Context- India's global leadership in the BPO-ITES industry.

Module:2	Differences in National Political Economy and Culture- Overview of Trade Theory	6 Hours

Mercantilism, Absolute advantage, comparative advantage; New Trade theory; and Porter's competitive advantage

Module:3	International Business Environment	7 Hours

Free trade and trade barriers – tariff and non- tariff barriers - Regional economic integrations – EU, NAFTA, ASEAN, SAARC, and Indian experience with regional and bi lateral agreements.

Module:4	The development of the world trading system	5 Hours

International Financial and Development Institutions , World Bank WTO (incl. DSB), and IMF.

Module:5	The Foreign Exchange Market -Basics - Foreign Direct Investment (FDI)	6 Hours

Benefits and Costs		
Module:6	**International Market Entry Strategy and Operation**	**6 Hours**
The strategy of International Business, Entry Strategy and Strategic Alliances.		
Module:7	**International Business Operations**	**7 Hours**
Global Manufacturing, Marketing, Logistics, Human Resource and Financial Management. Review of latest FTP of India (i .e. FTP 2015 - 2020) ; its direct ions and justifications . Pol icy evaluation of SEZ.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)				
1.	Sharan,V (2010), International Business; Concept, Environment and Strategy ,Pearson Education,Singapore			
Reference Books				
1.	Hill, C., & Jain, A.,K., (2014) International Business: Competing in the Global Market Place, McGraw Hill, New Delhi			
2	Daniels, Radebaugh, & Sullivan (2014), International Business: Environments and Operations, Pearson Education Inc, New Delhi			
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar				
Project				
1.	Project			60 hours
			Total Project	**60 hours**
Recommended by Board of Studies	03-03-2016			
Approved by Academic Council	No. 40	Date	18-03-2016	

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Course code	Course title	L	T	P	J	C
MGT1032	Managing Asian Business	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Provide orientation towards conduct of business in Asian countries
2. Offer insights on diverse management style practiced by Asian companies.
3. To provide knowledge of Asian culture and its implications on conduct of business

Expected Course Outcome: On the completion of this course the student will be able to:

1. Knowledge of unique business practiced in Asia
2. Students would be able to understand the Asian culture and its impact of management style.
3. Appraise students with knowledge of regional economic cooperation treaties
4. Able to understand culture and its impact business
5. Familiarize Chinese, Japanese and Korean Business models
6. Understand Indian Information Technology industry

Student Learning Outcomes (SLO):	2,3,7,19

Module:1	5 Hours

Asian Business: Understanding Business history of Asia. Asian management models, political & economic history of Asia; ASEAN and its role; Asian Tigers & the South East Asian crisis

Module:2	5 Hours

South East Asian cooperation: ASEAN & its role; Role of India, PRC in ASEAN. Structuring of FTAs and their implementation

Module:3	8 Hours

Asian Culture: Introduction to major cultures, business & societies of Asia: the Chinese; Indian; Japanese; and Korean. The People's Republic of China and communism- reform and open-door pol icy – Market economy and red capitalism.

Module:4	6 Hours

New China: PRC's WTO track record. New Age Chinese enterprises - Issues of censorship- MNCs experiences- Issues of Sourcing.		
Module:5		**5 Hours**
Japanese Business Model : Japanese culture and society—key factors in Japan's post war success — Japanese management model - post bubble Japan and the management model in transition		
Module:6		**5 Hours**
The Korean Businesses: Rise of Chaebols, Their role in Korean economy- Cases of Major Korean Corporations - their expansion strategies.		
Module:7		**8 Hours**
Indian Multinationals: IT and non- IT MNCs; Their genesis, their expansion strategies		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)		
1.	Harvard Business on Doing Business in Asia, (2004) Harvard Business School Press, MA.	
Reference Books		
1.	Helen Deresky (2013), International Management: Managing across borders and cutures, PearsonPrentice Hall.	
2	Hodgetts, R., M., &Luthans F, (2005), International Management , Tata McGraw HillPublications, New Delhi.	
3	Murray, G.(1994), Doing Business in China: The last great Market, China Library.	
4.	Fishman, Ted.C.,(2005), China Inc., Scribner International , New York.	
5	Wee, Lee and Hidajat, (2004),Sun Tzu – War and Management , Pearson Education, Singapore	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
Project		
1.	Project	60 hours
	Total Project	**60 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1033	Research Methods in Management	2	1	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Familiarise the principles of scientific methodology in business enquiry
2. Develop analytical skills of business research
3. Develop the skills for scientific communications

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand the fundamental concepts of business research
2. Get acquainted with the scientific methodology in business domain
3. Formulate data collection instruments
4. Familiar with the measurement scales
5. Analysis the collected data
6. Write business research report and presentation

Student Learning Outcomes (SLO):	1,2,3,4,5,6,7,14,16

Module:1	Foundations of Research	7 Hours

Meaning, Objectives, Motivation, Utility. Characteristics of scientific method - Concept, Construct, Definition, Variable. Research Process - problem Identification & Formulation – Management Quest ion – Research Question – Investigation Question

Module:2	Research design	6 Hours

Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept , types and uses, Descriptive Research Designs – concept , types and uses. Experimental Design

Module:3	Measure of association	6 Hours

Causal relationships, Concept of Independent & Dependent variables, concomitant variable, extraneous variable, Treatment, Control group

Module:4	Qualitative and quantitative research	7 Hours

Process of Qualitative research – Quantitative research – Merging qualitative and quantitative methodologies - Concept of measurement, causality, generalization, and replication

Module:5	Types of Data	6 Hours

Secondary Data – Definition, Sources, Characteristics. Primary Data – Definition, Advantages and disadvantages over secondary data, Observation method, Questionnaire Construction, Personal Interviews, Telephonic Interview, Mai l Survey, Email/Internet survey.

Module:6	**Sampling**	**6 Hours**
Concepts of Statistics - Population, Sample, Sampling Frame, Sampling Error , Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi -stage sampling. Non Probability Sample – Judgment , Convenience, Quota & Snowballing methods. Determining size of the sample – Practical considerations in sampling and sample size		
Module:7	**Report writing**	**7 Hours**
Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts , percentages), Bivariate analysis – (Cross tabulations and Chi -square test including testing hypothesis of association.) - Interpretation of Data and Report Writing – Layout of a Research Paper		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**30 hours**

Text Book(s)		
1.	E., Cooper, D. R., Schindler, P. S., & Sun, J. (2006). Business research methods. Tata McGraw Hill.	
Reference Books		
1.	Zikmund, W., Babin, B., Carr, J., & Griffin, M. (2012). Business Research Methods. Cengage Learning	
2	Hair , J . F. , Black, W. C. , Babin, B. J . , Ander son, R. E. , & Tatham, R. (2006) , Multivariate Data Analysis: Pearson Education. New Jersey: Hoboken	
3	Kothari, C. R. (2004). Research methodology: Methods and techniques. New Age International	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
Project		
1.	Project	60 hours
2.	Tutorial	15 hours

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1034	Project Management	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Learn methods of Project planning
2. Gain practical skills of project implementation
3. Demonstrate managerial qualities in project environment

Expected Course Outcome: On the completion of this course the student will be able to:

1. Achieve conceptual level knowledge in project management
2. Establish applied tools and techniques pertaining to project planning, scheduling and monitoring
3. Demonstrate project management software skills
4. Earned value analysis
5. Monitoring Techniques for crashing and overruns
6. Know the importance of regulatory and environmental norms

Student Learning Outcomes (SLO):	1,2,5,6,7,9

Module:1	Introduction	5 Hours

Fundamentals of Project & Project Management; difference between project and production; project classification; activities involved in and resource requirement for a project; Statutory authorities; Rules and Regulations; MSME; SSI units

Module:2	Project Planning	8 Hours

Project Planning; Project Scheduling – WBS; Network Scheduling ; rules for Network diagram; common errors ; CPM and PERT – concept and applicability, estimation of project completion time, estimating flexibilities; concept of Critical Path and its identification

Module:3	Project Crashing	12 Hours

Concept, need, applicability, process of crashing Commercial Aspects of Project : TEFR – preparing TEFR; chapters, importance of TEFR; Project Cost, Total Capital outlay, Source of fund, Financial Ratios for testing economic viability of project.

Module:4	Resource for Project	5 Hours

Estimation & control of cost, time and resources; inventory planning and stock management; Scheduling Resources; Resource Allocation methods; Time estimation
Procurement : Bid evaluation, selection of Vendors, Negotiation and Vendor Management;
Legal aspects of Contract : Delivery terms, Terms of payment, Performance measurement, Termination clause, Jurisdiction of courts, Arbitration;

Module:5	**Quality**	**4 Hours**
Quality assurance and quality control of project; project quality audit; Methods of enhancing quality; the different types of testing, inspections, reviews; Project Erection: Erection & installation of plant & machineries, construction and infrastructure; Test Run & commissioning; delivery & handover		
Module:6	**Risk and Uncertainty in Project**	**5 Hours**
Uncertainties & Risk identification; types of Risk; Risk Prioritization; Risk Management – Risk Avoidance, Risk Transfer, Risk Reduction, Risk Mitigation and Contingency Planning, Risk registers. Project Management software : for resource allocation, scheduling & control, Progress monitoring; corrective action		
Module:7	**HR & Legal aspects of project**	**4 Hours**
Human Resource Management; Health, Safety, Occupational hazards; environmental aspects and Ethical issues in project; Governmental rules and regulations, ESI, Workmen compensation - Medical facilities		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**30 hours**

Text Book(s)		
1.	Grag and Lawron, (2006), Project Management, Tata McGraw Hill.	
Reference Books		
1.	Reck and Crane, (2000), Project Management, Wiley Eastern	
2	Dennis Locke, (2000), Project Management, Gower	
3	Morris and Pritco, (2004), Managing Projects, Wiley Eastern	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
Project		
1.	Project	60 hours
	Total Project	**60 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1035	Operations Management	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Learn methods of Project planning
2. Gain practical skills of project implementation
3. Demonstrate managerial qualities in project environment

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand Operations Management functions and concepts
2. Enable to comprehend the aspects like production layout, production planning and inventory management
3. Ability to understand the Operation process and techniques
4. Ability to measure performance of functional operations
5. Ability to design process models in functional areas

Student Learning Outcomes (SLO):	1,2,5,6,7,9

Module:1	Introduction	4 Hours

Concept; Manufacturing and Services; Interrelationship with other functional areas; Operation Strategies to enhance competitiveness; Value Chain

Module:2	New Product Development Process	6 Hours

Product Life Cycle; Kano Model; Customer Attribute; QFD; Demand Forecasting

Module:3	Product and Process Design	2 Hours

Type and design of product, Process – Job shop, Batch, Continuous & Assembly line; Business Process Reengineering

Module:4	Productivity	3 Hours

Concept; Influencing factors and improvement of Productivity; Value Analysis and Value Engineering

Module:5	Facility Location and Layout	5 Hours

Plant Location selection; Layout planning - Product Layout, Process Layout, Fixed Position Layout, Cellular Layout of Group Technology

Module:6	Production Planning and Control	9 Hours

Capacity Planning; Aggregate Planning; Master Production Scheduling; Bill of Materials; MRP.

Inventory Management:

Inventory – type, purpose, levels; Inventory Cost; Stock-Time diagram; EOQ; Selective Inventory Control

Module:7	**Procurement, Quality Management, Maintenance**	**14 Hours**

Procurement:
Purchasing Management; Vendor Management and Vendor Rating ; Supply Chain Strategy; Theory of Constraints; Enterprise Resource Planning; Lean Manufacturing; JIT

Quality Management::
Concepts of Quality and Reliability; Quality Control; TQM concept; Quality Award – Malcom Baldridge Award ; Taguchi's loss function; Bench Marking; QMS – ISO 9001; ISO 14000;SERVQUAL

Maintenance:
Types of Maintenance – Preventive Maintenance – Productive Maintenance – Total Productive Maintenance (TPM) – FMEA

Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)

1.	Roberta S. Russell & W. Taylor 111, (2006), "Operations Management", 4th Edition Pearson Education.

Reference Books

1.	Chase, Jacobs and Aquilano, "Operations Management for Competitive Advantage", 10th Edition, Tata McGraw Hill
2	E.S. Buffa, Modern Production / Operations Management, 7th Edition, Wiley Eastern Publications, 1997
3	T.G. Monks, "Operations Management",3rd Edition, Tata McGraw Hill, 1997
4	S. N. Chari, "Production and Operations Management", Tata-McGraw Hill, 1988.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

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Course code	Course title	L	T	P	J	C
MGT1036	Principles of Marketing	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Explore and understand the need of study on Marketing
2. Apply the acquired skill in to real world problems
3. Utilize marketing management tools for competitive advantage

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand the basic principles, theories, concepts and dynamics of Marketing.
2. Apply these principles and tools in case analysis and to practical business decision making
3. Ability to prepare a comprehensive marketing plan.
4. Appreciate and learn more about Marketing as a career.
5. Understand and apply market segmentations
6. Measure marketing performance metrics

Student Learning Outcomes (SLO):	1,2,3, 4, 5, 6,7, 9,10, 11,12,13,16, 17

Module:1	Introduction and overview	6 Hours

Definitions of Marketing, Marketing Vs selling, history of business orientations, meaning of exchange and value, types of market and ethics in marketing.

Module:2	Analyzing Marketing Environment	6 Hours

SWOT Analysis, types of Environment (Micro and Macro) and Porter ' s industry analysis

Module:3	Consumer Behaviour	8 Hours

Understanding consumer behaviour , consumer buying decision process, types of consumer buying behaviour , and organizational buyer behaviour

Module:4	Segmentation, Targeting and Positioning	7 Hours

Levels of segmentation, identification of bases of segmentation, evaluation of segment attractiveness, targeting one or more segment based on attractiveness, and positioning the product through different positioning strategies.

Module:5	Four Ps: Product	6 Hours

Product classifications, product levels, product line and mix concept , product life cycle, Ansoff matrix, BCG mat r ix, branding, packaging and new product development ;
Price: Pricing policies and strategic pricing method;

Module:6	Place	6 Hours

Different types of distribution channels ,importance of channel member relationship;
Promotion:

Integrating marketing communications – advertising, sales promotion, direct marketing, online marketing and public relations			
Module:7	**Marketing Plan**		**4 Hours**
Complete marketing plan including executive summary, environment analysis, objectives, marketing strategy, marketing mix, implementation, financial requirement and control			
Module:8	**Contemporary issues:**		**2 Hours**
	Total Lecture		**45 hours**
Text Book(s)			
1.	Kotler, P. and Armstrong, G, (2012), Principles f Marketing, Upper Saddle River, NJ: Pearson Prentice Hall, 14th International Edition		
Reference Books			
1.	Kotler, P, (2006), Marketing Management, Prentice & Hall, 11th Edition		
2	Ramaswamy, V.S and Namakumar i , S, (2010) , Market ing Management - Global perspective, Indian Context , Om Books, 4t h Edition		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Project			
1.	Project		60 hours
		Total Project	**60 hours**
Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1037	Financial Accounting and Analysis	2	1	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Understand the working knowledge of basic accounting terminology
2. Implement and analysis the finance and accounting tools in decision making

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand concepts and accounting standards
2. Compute, classify, record, and verify numerical data, in order to develop and maintain financial records
3. Approach and solve real business related issues with ethical and socially sensitive perspectives
4. Analysis and interpret Financial statements
5. Effective uses of ratio analysis
6. Know the need and importance inventory valuation

Student Learning Outcomes (SLO):	1,2,7,9,10

Module:1	Introduction to Accounting	4 Hours

Meaning & Concept of Financial Accounting – Historical trace of Accounting - Functions and Sub fields of Accounting – Accounting Cycle – Accounting Concepts & Convent ions and Generally Accepted Accounting Principles (GAAP) their implications on accounting system.

Module:2	Basic Accounting Procedures	3 Hours

Double entry system - Classification of Accounts – Golden Rules of Accounting

Module:3	Accounting Cycle	4 Hours

Books of original record; Journal , Ledger –Subsidiary ledgers - Trial Balance

Module:4	Final Accounts	5 Hours

Preparation of Final Accounts; Trading, Profit and Loss Account – Balance Sheet

Module:5	Inventory valuation	4 Hours

The basics of inventory - Inventory accounting systems - Inventory valuation methods - Inventory and its impact on financial statements

Module:6	Financial Statement Analysis I	3 Hours

Analysis and interpretation of financial statements from investor and company point of view, Horizontal Analysis and Vertical Analysis of Company Financial Statements - Window Dressing and limitations of financial statements

Module:7	**Financial Statement Analysis II**	**5 Hours**
Ratio Analysis: Nature – Use and Significance of Ratio Analysis – Classification of Ratios -Fund f low and cash f low statements – Utility – Limitations **Financial Reporting:** Corporate Financial Reporting -Issues and problems with special reference to published financial statements IAS, IFRS		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**30 hours**

Text Book(s)	
1.	Dhanesh K .Khatri (2012) Financial Accounting & Analysis, Tata McGraw-Hill Publishing Limited, New Delhi
Reference Books	
1.	Gupta R. L. and Gupta V. K. , (2012) , Financial Accounting, S. Chand & Sons Publications, New Delhi
2	Asish K. Bhattacharvya, (2012) Financial Accounting for Business Managers, 4t h Edi t ion, Prentice-Hal l India, New Delhi
3	Ramachandran N and Kakani , Ram Kumar , (2011) , Financial Accounting for Management , 3rd Edition, Tata McGraw Hill
4	Narayanaswamy R. (2011) , Financial Accounting A Managerial Perspective, 4thEdition, Prentice Hall of India
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

Project and tutorial		
1.	Project	60 hours
2.	Tutorial	15 hours

Recommended by Board of Studies	03-03-2016		
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Course code	Course title	L	T	P	J	C
MGT1038	Financial Econometrics	2	0	0	4	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Learn econometric techniques relating to the estimation of parameters
2. Use econometric modeling for business

Expected Course Outcome: On the completion of this course the student will be able to:

1. Familiarize basic concepts of econometric models
2. Demonstrate data preparation methods for analysis
3. Understand the application of econometric tools used for financial analysis
4. Understand the concepts, methods, applications and usefulness of time series analysis to various problems relating to finance and other avenues of business
5. Understand and estimate various volatilely models
6. Apply various test to determine stationarity and regression

Student Learning Outcomes (SLO):	1,2,7,9,10,14

Module:1	Introduction	3 Hours

Econometrics – Meaning - Importance -Historical perspective of Econometrics- Linkage with Business Forecasting. Econometric package for modelling finance data

Module:2	Sources of Data	3 Hours

Nature and source of Data for econometric analysis- types of data – cross section – time series – panel data-dummy variable - Instrumental variable

Module:3	Estimation Techniques I	4 Hours

Correlations – Types of Correlation - Simple linear regression model -Methods of Ordinary least squares –R2 and adjusted R2 - assumptions and properties of OLS estimators –Standard errors of least square estimates

Module:4	Estimation Techniques II	4 Hours

Multiple Regression analysis -Analysis of variance (F test) – Testing the equality of two regression coefficient – Chow test – Prediction with multiple regression

Module:5	Volatility Models	4 Hours

Heteroscedasticity – testing for Heteroscedasticity – ARCH and GARCH Models and their extensions

Module:6	Stochastic Processes	3 Hours

Stationary stochastic processes -non stationary stochastic processes Phenomenon of spurious regression - integrated stochastic process

Module:7	**Tests of Stationarity**	**5 Hours**
Tests of Stationarity – Graphical analysis – Auto Correlation Function (ACF) and Correlogram – Statistical significance of Autocorrelation coefficients. The Unit root test – The Augmented Dickey Fuller (ADF) test – Testing the Significance of more than one coefficient – The Phillips Perron (PP) Unit root tests-Kpss test. **Multivariate Analysis:** Cointegration-Models of parameter estimation-VECM –VAR –Granger casuality.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**30 hours**

Text Book(s)				
1.	Gujarati , N.D. , (2013) , Basic Econometrics, fifth edition, McGraw Hill			
Reference Books				
1.	MarnoVerbeek (2012) : A guide to Modern Econometrics, 4/e, Wi ley and Sons			
2	Johnston, J . , (2006) : Econometric Methods, third edition, McGraw Hill			
3	Wooldridge, J (2012) : Introductory Econometrics: A Modern Approach, 5/e, South- Western			
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar				
Project				
1.	Project			60 hours
			Total Project	**60 hours**
Recommended by Board of Studies	03-03-2016			
Approved by Academic Council	No. 40	Date	18-03-2016	

Course code	Course title	L	T	P	J	C
MGT1039	Financial Markets and Institutions	2	0	0	4	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Acquire knowledge to get an overview of Financial System in India
2. Understand the Primary market and Secondary market operations
3. Understand the technology driven financial market environment

Expected Course Outcome: On the completion of this course the student will be able to:

1. Financial structure and its influence on financial system of a nation. Reforms and their impact on economy and money markets.
2. Role of financial institutions in the economic growth of India over time and how monitoring and regulation takes place from governance point of view.
3. Evolution of financial markets, role of primary and secondary markets in economic growth, their functioning and impact on governance.
4. Financial service prevailing and their functioning
5. Application of technology in financial markets and its advantages

Student Learning Outcomes (SLO): 1,2, 3,6,8,9

Module:1	Overview of Financial Environment	4 Hours

The nature and role of financial system- Financial structure – Different financial functions - Financial system and economy - Reforms in the financial system- Role of financial markets and Institutions -Recent developments.

Module:2	Financial Institutions	4 Hours

Overview of Financial Institutions - Regulatory and non- regulatory institutions -Banking and nonbanking institutions – Role and functions

Module:3	Financial Markets	4 Hours

Evolution of financial markets - functions - Classifications – Role of Regulator in financial markets.

Module:4	Primary Market	4 Hours

Primary vs. secondary markets New issues -Primary market operation- intermediaries – lead managers -underwriting-bankers to issue- listing mechanism– listing regulations. Registrar and share transfer agents

Module:5	Secondary Market	4 Hours

Stock exchanges - intermediaries and stock broking services –custodial services –depository system-clearing and settlement systems. Role of technology in financial markets operations

Module:6	**Money Market**	**4 Hours**
Instruments - Intermediaries – importance and applications		
Module:7	**Fee based Financial services**	**3 Hours**
Merchant banking - Mergers and Acquisitions – Credit Syndication – Credit Rating **Fund based Financial services:** Leasing – Hire Purchasing- Mutual Funds -Bills Discounting – Factoring and Forfaiting –Housing finance – Venture Capital - Insurance		
Module:8	**Contemporary issues:**	**3 Hours**
	Total Lecture	**30 hours**

Text Book(s)		
1.	M.YKhan (2013), Indian Financial System, 8th Edition, Tata McGraw Hill Education	
Reference Books		
1.	L.MBhole and Jitendra Mahakud (2009) , Financial Institutions and Markets, McGraw Hill Education.	
2	Bharat iV.Pathak (2014) , Indian Financial System, 4 t h Edi t ion, Pearson education	
3	Fredric.S Mishkin, Stanley G Eakins (2011) , Financial Markets and Institutions, 6 th Edition, Pearson education.	
4	Gurusamy.S (2009) , Indian Financial System, 2 nd edition, Tata McGraw Hi l l .	
5	Gomez,Cl i f ford (2008) , Financial Markets , Institutions and Financial Services, PHI learning.	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
Project		
1.	Project	60 hours
	Total Project	**60 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

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Course code	Course title	L	T	P	J	C
MGT1040	Personal Financial Planning	2	0	0	4	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Familiarize basics of Personal financial concepts, its need and how to plan for his career based on CBDT norms
2. Understand the Personal financial management process
3. Construct, manage and evaluate a Portfolio

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understanding the difference between savings and investment and Setting of Financial Goals and factors influencing them.
2. Need for understanding inflation and time value of money concepts and their applications.
3. Career options available and planning, financial planning, budgeting and asset-liability management.
4. Tax planning, financial services prevailing in market, Credit plannning and utilization, Insurance planning.
5. Selection of Investment options and building personal financial portfolio
6. Retirement planning, estate planning, etc.

Student Learning Outcomes (SLO):	1, 2,7, 9,12

Module:1	Personal Finance Basics	3 Hours

The financial planning process – setting goals-achieving goals. Time value of money and opportunity cost concepts.

Module:2	Career Planning and Financial Planning	3 Hours

Career choice – opportunities – long term career development. Money management –personal financial records –asset and liability – budgeting

Module:3	Macroeconomic environment	6 Hours

Economic growth – business cycles inflation – interest rates- banking and financial markets.
Tax Planning: Income tax – tax on property, wealth and earnings tax filing-PAN – tax planning strategies.

Module:4	Financial Services	4 Hours

Financial institutions-savings –payments – methods.
Credit Planning-type of credit –home, auto and personal loans. Consumer credit. Credit cards. Purchasing decisions.

Module:5	Insurance Planning	3 Hours

Life Insurance –health insurance –Property insurance. Insurance and tax planning. ULIPs

Module:6	**Investment management**	**5 Hours**
Investment plan-factors influencing – asset allocation-source of information. Investing in stocks – short term vs long term –stock evaluation and analysis. Portfolio concepts.		
Module:7	**Mutual funds**	**4 Hours**
Fixed income securities-real estate investments. Precious metals –alternate investments. **Controlling financial future**: Retirement planning –financial analysis- planning for retirement income. Estate planning –will-trust-estates.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**30 hours**

Text Book(s)		
1.	Personal Finance 8E, Jack Kapoor, Les Dalbay, Robert J Hughes 2007, McGraw-Hill India	
Reference Books		
1.	Personal Finance,11E,Garman, Forgue, 2015, Cengage	
2	Principles of Insurance 2011, Insurance institute of India	
3	Personal Financial Planning, 2012, Insurance Institute of India	
4	Personal Financial Planning 13E, Gitman, Joehnk, Billingsley 2014, Cengage India.	
5	Basics of Personal Financial Planning, National Insurance Academy 2009,Cengage India	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
Project		
1.	Project	60 hours
	Total Project	**60 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1041	Financial Derivatives	2	1	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Learn about various derivative markets and products
2. Understand the Global and domestic economic environment and its influence on financial markets
3. Acquire financial statement analysis skills and application of the same

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand various risks in financial markets
2. Understanding theoretical foundations of financial derivatives
3. Achieving skills in measuring financial risks.
4. Learning applied financial risk modelling.
5. Achieving risk management using derivatives.
6. Professional risk advisory skills

Student Learning Outcomes (SLO):	1,2,5,7,9,18

Module:1	Introduction	3 Hours

Derivatives- definition-classification. Risk-risk management. Futures vs. forwards, OTC vs. exchange traded contracts. Futures and options on stocks, indices, commodities, exchange rates etc., understanding quotes

Module:2	Futures	6 Hours

Specification-spot, forward and future relationship convergence –delivery and settlement. Margi-margin call. Hedging strategies using futures. Determination of forward and future prices.
Options: Mechanics of option market-option properties- Put, call, American and European options. Put-call parity –underlying asset

Module:3	Option trading strategies	7 Hours

Single option strategies- multiple option strategies –neutral and volatility based strategies.
Option pricing model: Black-Scholes option pricing model assumptions- theoretical vs market price – volatility-historical and implied volatility- volatility estimation-volatility smile

Module:4	Option Greeks	3 Hours

Delta –delta hedging-theta-gamma-vega-rho – relationship between them

Module:5	Credit derivatives	3 Hours

Credit risk-credit default swap –asset backed securities-collateralized securities

Module:6	Swaps	3 Hours

LIBOR – interest rate swaps- currency swaps- total return swaps– other types				
Module:7	**Commodity derivatives**			**3 Hours**
Commodity market –commodity price risk futures and options on commodities –hedging using commodity derivatives				
Module:8	**Contemporary issues:**			**2 Hours**
	Total Lecture			**30 hours**
Text Book(s)				
1.	Options, Futures and Other Derivatives 8E , by John C. Hull ,2013 ,Pearson India.			
Reference Books				
1.	An Introduction to Derivatives and Risk Management , 9E, by Don M. Chance , Robert rooks , Cengage India			
2	Derivatives An Introduction 2E,by Robert A. Strong , South-Western			
3	Financial Risk Manager Handbook: FRM Part I / Part II, by Philip Jorian, 2013 ,Wiley			
4	Risk Management and Financial Institutions, 3E, John C. Hull ,Wiley			
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar				
Project and tutorial				
1.	Project			60 hours
2.	Tutorial			15 hours
Recommended by Board of Studies	03-03-2016			
Approved by Academic Council	No. 40	Date	18-03-2016	

Course code	Course title	L	T	P	J	C
MGT1042	Investment Analysis and Portfolio Management	2	0	0	4	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Learn about financial market analysis and stock selection technique
2. Achieve investment advisory skill

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand the linkages between Macroeconomic environment and financial markets
2. Understand theoretical foundations of financial markets
3. Achieve skills in financial statement analysis
4. Learn applied financial security analysis
5. Achieve portfolio construction and evaluations techniques
6. Demonstrate professional investment advisory skills

Student Learning Outcomes (SLO): : 1, 2, 3 ,5,7,9, 10,18

Module:1	Macroeconomics and Financial Markets	3 Hours

Economic growth business cycles-inflation-interest rates. Monetary policy and fiscal policy. Global economic indicators.
Financial markets – institutions –regulatory framework.

Module:2	Investment theories	3 Hours

Efficient market hypotheses- Random walk-modern portfolio theory-DOW theory.
Risk and return –Beta – CAPM, SML, efficient frontier. Portfolio models

Module:3	Financial Statement Analysis	3 Hours

Financial statements –standalone vs consolidated– balance sheet, Profit & loss, cash flow statements analysis –ratio analysis –common size and comparative analysis

Module:4	Fundamental Analysis	3 Hours

EIC analysis-top down approach-Value investing principles-short term vs long term investing-qualitative and quantitative factors. Valuation models

Module:5	Equity valuation	8 Hours

Cost of capital –WACC-growth estimation- cash flow estimation –DCF models.
Technical Analysis: Charts- line, Candle stick and bar charts-technical indicators-oscillators-cart patterns and trends- rule based filtering – back testing.

Module:6	Fixed income securities	4 Hours

Bonds-corporate and Govt. securities -treasury securities-types. Bond yield, maturity –bond valuation-duration and modified duration. Bond portfolio strategies.

Module:7	**Portfolio Management**	**4 Hours**
Portfolio management process- tools and techniques –evaluation. Sharpe ratio, Jensen alpha and Treynor index. **Mutual funds and alternate investments:** Mutual funds – classification- mutual fund investments –SIP. Hedge funds. REITs.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**30 hours**

Text Book(s)		
1.	Analysis of Investments and Management of Portfolios 10E, by Frank K Reilly, Keith C. Brown, 2012, Cengage India.	
Reference Books		
1.	Investments 10E, by Zvi Bodie, Alex Kane, Alan J Marcus, Pitabas Mohanty ,2015, McGraw Hill, India	
2	Investments: Principles & Concepts ,12E by Char les P Jones , 2016,Wiley Finance	
3	Fundamentals on Investing ,Lawrence Gitman ,2011, Pearson India	
4	Bond Market Analysis and strategies, Frank J Fabozzi , 2013, Pearson India	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
Project		
1.	Project	60 hours
	Total Project	**60 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1043	Applications in Neuromarketing	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Coverage of neuroscience to marketing research.
2. Evaluation methods comparison of various neuro marketing techniques
3. Provide the an overview of marketing concepts

Expected Course Outcome: On the completion of this course the student will be able to:

1. Get conversed with fundamentals of Neuroscience & Neuro-marketing
2. Understand the application of various neuro marketing techniques and practices.
3. Understand the buying behavior of consumers based on neuroscience
4. Correlate Nervous System and Brand Communication
5. Demonstrate Neuroscience, Marketing Decisions and Ethical Issues
6. Familiarise Experience Economy

Student Learning Outcomes (SLO):	:2,3,4,8,10,12,14,18

Module:1	Basics of Neuroscience & Neuromarketing	6 Hours

Structure of nervous system, Senses & Cognition, Memory and Learning

Module:2	Involvement of Feelings in Consumption Situation	6 Hours

Delight, Want & Reinforcements, Feel of Comfort, Beauty through Buyers' Brain

Module:3	Experience Economy	6 Hours

Positive Experience as a Sensory Impression, Emotional Involvement, Mood Affects & Buyer Behaviour

Module:4	Neuroscience & Neuromarketing in Buying Situations	6 Hours

Risk Adjustments, Choice Confusion, Memory-Learning & Intuitions, Branding & Brain Functions

Module:5	Neuroscience, Marketing Decisions and Ethical Issues	6 Hours

Using neuroscience for marketing Decisions, Feeling as outcome, Ethical issues in Neuromarketing

Module:6	Autonomic Nervous System and Brand Communication	4 Hours

GSR and its usefulness to marketing, Somatic markers, emotions, learning, autonomic nervous

system and decision-making				
Module:7	**Research Experiments in Neuromarketing I**			**10 Hours**
Advertising research, Neuro-images of advertising, Advertising and brain, Thinking and feeling, Impact of media, product and message on brain waves. Research Experiments in Neuromarketing II Familiar brands affected by contextual inference, attribute size and brand purchase				
Module:8	**Contemporary issues:**			**2 Hours**
	Total Lecture			**45 hours**
Text Book(s)				
1.	J K Sharma, Deepali Singh, K K Deepak, D P Agarwal, Neuromarketing : A Peep Into Customer's Minds, Eastern Economy Edition.			
Reference Books				
1.	Patrick M Georges, Anne-Sophie Bayle-Tourtoulou, Michel Badoc (2014), Neuromarketing in Action - How to Talk and Sell to the Brain Kogan Page India Private			
2	Stephen J Genco, Andrew P Pohlmann, Peter Steidn, Neuromarketing For Dummies, Wiley India			
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar				
Project				
1.	Project			60 hours
			Total Project	**60 hours**
Recommended by Board of Studies	03-03-2016			
Approved by Academic Council	No. 40	Date	18-03-2016	

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Course code	Course title	L	T	P	J	C
MGT1044	Global Brand Marketing Strategies	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Understand the methods of managing brands and strategies for brand management
2. Learn nature, scope and structure of International Business.
3. Understand the influence of global environmental factors on international business operations

Expected Course Outcome: On the completion of this course the student will be able to:

1. Establish and sustain brands and lead to extensions
2. Understand the geopolitical and roll and function of trade bodies
3. Understand theoretical concepts of international business
4. Learn the Service branding
5. Familiarize with Product branding
6. Understand brand portfolio

Student Learning Outcomes (SLO):	2, 4,5, 11,12,14,18

Module:1	Basics of Branding	5 Hours

Visual & Verbal Portions of Brand, Brand Name, Logo, Trade Mark, Jingle, Slogan, Mascot, Brand Graphics, Brand Ambassador and Brand Personality.

Module:2	Brand Portfolio & Architecture Management	6 Hours

Product – Brand Matrix, Monolithic Branding, Endorsed Branding, Family Branding, Co-Branding and Hybrid Branding

Module:3	Brand Building	6 Hours

Brand Equity & Consumer Based Brand Equity – Brand Loyalty, Brand Awareness, Brand Meaning, Brand Response, Brand Relationship, Proprietary Assets.

Module:4	Product Branding	5 Hours

Branding of Consumer Electronics, Automobiles,
Soft Goods and FMCG Categories.

Module:5	**Services Branding**	**7 Hours**
Branding in Non-profit organization sector, Destination Branding, Hospitality & Entertainment Industry		
Module:6	**Recent Trends in Branding**	**7 Hours**
Luxury Branding, Personal branding, Idea Branding, Private Label Branding, Green Branding, and Social Media in branding		
Module:7	**Brand Assessment Techniques**	**7 Hours**
Brand Strength, Brand Health, Brand Market Share, Herfindahl index, BDI, CDI, HUI and Customer Loyalty Assessment, Share of Voice		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)		
1.	Kevin Lane Keller (2015), Strategic Brand Management, 4th Edition, Pearson Education	
Reference Books		
1.	Jean-Noël Kapferer (2012), The New Strategic Brand Management: Advanced Insights and Strategic Thinking (New Strategic Brand Management: Creating & Sustaining Brand Equity), 5th Edition, Kogan Page	
2	Y. L. R Moorthi (2003), Brand Management, First Edition, Vikas Publishing House	
3	Philip Kotler, Waldemar Pfoertsch & I. Michi (2006), B2B Brand Management: The Success Dimensions of Business Brands, Kindle Edition, Springer Berlin Heidelberg	
4	S. Ramesh Kumar (2002), Managing Indian Brands, Second Edition, Vikas Publishing House	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
Project		
1.	Project	60 hours
	Total Project	**60 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1045	Industrial Marketing	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Develop various marketing plan for industrial products
2. Apply of various industrial marketing strategies.
3. Plan strategic planning process at business unit level

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understanding the importance of marketing
2. Understanding the importance of Marketing related to industrial Requirements
3. Familiarise purchase function in an organisation
4. Explain various industrial product life cycle
5. Develop Industrial product marketing channel
6. Understand electronic commerce

Student Learning Outcomes (SLO):	2, 5,9,16

Module:1	Introduction to industrial marketing and industrial products	5 Hours

Classification of industrial products and services. Customer Value Proposition, Trends, Exploring Business to Business Environment , Customers, Markets.

Module:2	Buyer -Seller Relationship, Supplier Choice and Evaluation, Purchasing Function and Documentation	6 Hours

Organizations Buying Process, The concept of buying center and buying influences, Models of organizational buying behavior , The Buy-grid framework

Module:3	Strategic planning process at business unit level	6 Hours

Market Research, Segmenting, Targeting and Positioning, Developing Product , Service and Value of the offering, Methods used to influence business customers. Industrial marketing intelligence system.

Module:4	Industrial product life -cycle and strategies	6 Hours

New Product Development Process, Innovation and Competitiveness, Business to Business Branding, Developing product strategies for existing products.

Module:5	Factors influencing pricing decisions	5 Hours

Pricing Basics and Objectives, Price Models and Skills , Pricing tactics, Negotiated Pricing, Role of leasing.

Module:6	**Channel Design and Management**	**5 Hours**
Channel Opportunities and Relationships, Channel Motivation and Conflicts. Supply chain management and logistics		
Module:7	**Introduction to business marketing communication**	**7 Hours**
Elements of the Promotion Mix, Managing B2B Advertising – Budget , Message and Media Strategy, Internet Communication with the Market , Trade Shows Strategy. Branding in business markets. Introduction to E-commerce, Models for B2B Ecommerce, Key Account Management , Corporate Requirement Analysis , Use of Internet and Web Technologies for B2B marketing. Key efficiently indicators and ethical aspects in business marketing		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)		
1.	Brennan, R. , Canning, L. , and McDowel l , R. 2007. Business - to-Business Market ing. London: SAGE	
Reference Books		
1.	Hut t , Michael D and Speh, Thomas W (2009) , Business Marketing Management : B2B, 9t h edition, Thomas -Cengage Learning India, New Delhi	
2	El l is , Nick (2010) , Business to Business Marketing: Relationships Networks and Strategies, Oxford University Press	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
Project		
1.	Project	60 hours
	Total Project	**60 hours**

Recommended by Board of Studies	03-03-2016		
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Course code	Course title	L	T	P	J	C
MGT1046	Sales and Distribution Management	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Developing Sales plan, formation of channels, territories etc
2. Application of various sales strategies and practices.
3. Familiarize different sales processes

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understanding the important concepts of Sales and Distribution.
2. Familiarize with different functions and role of sales in an organisation
3. Understanding various sales strategies, Distribution channels in depth its importance
4. Familiarizer with sales processes in an organisation
5. Understand consumer behavior
6. Understand distribution management

Student Learning Outcomes (SLO): : 1,2, 3,5,7,9

Module:1	Basic Concepts	6 Hours

Needs, Wants , Demands, Evolution of Marketing – Product ion concept , Product concept , Sales concept , Marketing concept , Social concept

Module:2	Strategic Sales Management	7 Hours

Different functions in an organization and their connections with Sales ,
Marketing and Sales – definitions and differences, Roles of Sales in an organization

Module:3	Salesmanship Sales Process	6 Hours

Qualities required for Salesman, process of sales - Different process in sales

Module:4	Understanding Customers	6 Hours

Definition of Customer , Consumer behaviour and factors affecting it , Customer Satisfaction, Customer Delight, Customer Loyalty, and Comparison of Consumer Markets.

Module:5	Selecting and Training Sales Force	6 Hours

Various Select ion Process Different types of Training, on Jo

Module:6	Territory Management	7 Hours

Quotas Compensation and Evolution of Sales Force - Introduction to Strategic Distribution Management Strategic Channel Design

Module:7	Channel Power	5 Hours

Managing Conflicts in channel Evaluating and controlling Distribution Channel

Module:8	**Contemporary issues:**			**2 Hours**
	Total Lecture			**45 hours**
Text Book(s)				
1.	Sales Management Charles Futrell (2004) Sales Management , 6 t h edit ion Thomson,South Western.			
Reference Books				
1.	Marketing Channels – Anne T. Coughlan Erin Anderson, Louis W.Sternand Adel I E.I Ansary (2006) Pear son Education			
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar				
Project				
1.	Project			60 hours
			Total Project	**60 hours**
Recommended by Board of Studies	03-03-2016			
Approved by Academic Council	No. 40	Date	18-03-2016	

Course code	Course title	L	T	P	J	C
MGT1047	Social Marketing	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Apply the principles of commercial marketing to social change
2. Adapt, adopt and implement marketing for social change to present solutions for social problems to the market
3. Understand the limits of marketing as a mechanism for social change

Expected Course Outcome: On the completion of this course the student will be able to:

1. Describe and explain the meaning and nature of social marketing
2. Analysis social marketing problems prevailing in India and suggesting ways of solving these
3. Analysis the range of stakeholders involved in social marketing programmes and their role as target market.
4. Assess the role of 4Ps in achieving behavioral change
5. Application of various social marketing techniques and practices
6. Understand the importance of social wellbeing of the society

Student Learning Outcomes (SLO):	: 2, 3, 5,7, 10,11, 12, 14,18,19

Module:1	Introduction to social marketing	6 Hours

Principles, Steps in strategic marketing planning process, Social Change

Module:2	Analysing the social marketing environment	6 Hours

Social marketing environment and social marketing research, Determining research needs and options, Choosing a purpose and focus for your plan and conducting a situation analysis, Attitude and behaviour change, Segmenting, evaluating and targeting

Module:3	Selecting target audiences, objectives and goals	6 Hours

Setting behaviour objectives and goals, Identifying barriers, benefits ,the competition and influential others

Module:4	Developing social marketing strategies	6 Hours

Crafting a desiredpositioning,4Ps with respect to social marketing

Module:5	Managing social marketing programs	5 Hours

Developing a plan for monitoring and evaluation

Module:6	Developing a plan for monitoring and evaluation	4 Hours

Donor acquisition and designing fundraising campaign		
Module:7	**Creating an implementation plan for sustained behaviour**	**10 Hours**
Monitoring and control, Ethical issues in social marketing **Applications:** Social marketing and selected case studies		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)		
1.	Nancy R. Lee and Philip Kotler , (2011) , Social Marketing: Influencing Behaviour for Good, 4th edit ion, Sage Publication.	
Reference Books		
1.	Jef f French, Clive Blair -Stevens, Dominic McVay, Rowena Merritt , (2010) , Social Marketing and Public Heal th, Oxford Publ icat ion	
2	Nedra Kine Weinreich (2011) , Hands -on Social Marketing: A Step-by-Step Guide to Designing Change for Good, 2nd edition. , Sage Publication	
3	Rob Donovan and Nadine Henley (2010) , Principles and Practice of Social Marketing - an International Perspective, Cambridge University	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
Project		
1.	Project	60 hours
	Total Project	**60 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

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Course code	Course title	L	T	P	J	C
MGT1048	Political Economy of Globalization	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Apply the principles of commercial marketing to social change
2. Adapt, adopt and implement marketing for social change to present solutions for social problems to the market
3. Understand the limits of marketing as a mechanism for social change

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand the impact of Politics on Globalization
2. Understand the impact of Politics on Global Trade
3. Identify the actors of Globalization
4. Understand the challenges of International institutions
5. Global Civil Society
6. Familiarize Trade, Regionalism and the Threat to Multilateralis

Student Learning Outcomes (SLO):	: 2,5, 10, 11,12

Module:1	The Political Economy of Globalization	6 Hours

The expansion of markets; challenges to the state and institutions; and the rise of new social and political movements

Module:2	The New Geography of Foreign Direct Investment	6 Hours

Examining the changes in the geography of MNC activity, Understanding the Value chain activities of MNCs, OLI Framework, Emerging markets MNCs

Module:3	Trade, Regionalism and the Threat to Multilateralism	6 Hours

Capital Mobility Hypothesis, issue in cross border currency competition, strategies being used, role of symbolism

Module:4	Money in a Globalized World	6 Hours

Capital Mobility Hypothesis, issue in cross border currency competition, strategies being used, role of symbolism

Module:5	Globalization and National Autonomy	5 Hours

Role of state, non-state actors, , the reconfiguration of state's role, the concept of freedom in global economy, experiences in OECD and emerging economies

Module:6	**Globalization as a Mode of Thinking in Major Institutional Actors**	**6 Hours**
Identification of major actors, their operations and its trends. Impacts of such changes in developed & developing world, Consequences of globalization		
Module:7	**Global Civil Society**	**7 Hours**
Understand the global civil society & its functioning, its impacts in politics and economic spheres. Globalization and International Institutions: Globalization and institutionalization, challenges for international institutions, the challenges of regulation, special interest groups. Their overall effectiveness.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture:	**45 hours**

Text Book(s)		
1.	Ravenhill, John (2014) Global Political Economy, OUP Oxford	
Reference Books		
1.	Woods, Ngaire. (2000) The Political Economy of Globalization, Palgrave Macmillan	
2	Laursen, Finn (2009) The EU in the Global Political Economy, Peter Lang	
3	Oatley, T. (2006). International Political Economy: Interests & Institutions in the Global Economy, New York: Pearson-Longman	
4	Stiglitz. J (2006) Making Globalization Work, Penguin Books	
5	Bhagwati, Jagdish (2007) in Defense of Globalization: With a New Afterword, Oxford University Press	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
Project		
1.	Project	60 hours
	Total Project	**60 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1049	Sustainable Business Models	3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Appraise the sustainable Business Models
2. Develop socially conscious entrepreneur
3. Plan for Sustainable Development to Sustainable Business

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand and develop sustainable business models
2. Measure the impact of sustainable business models
3. Distinguish business model to sustainable business model
4. Creating sustainable Business Models
5. Make sustainability Measurement and Reporting

Student Learning Outcomes (SLO):	: 2, 6,11,14,18

Module:1	Introduction to Business Model	6 Hours

Concept ; Basic principles; Comparative Perspectives – Strategy, Industrial Ecology, Socio-Governmental , Transition

Module:2	Sustainable Development	6 Hours

Impact of Industrial revolution on environment and society leading to sustainability risks to industry; Green Business to CSR to Corporate Sustainability; Sustainability perspectives in developed vs developing nations; Phases of CSR in India.

Sustainable Development to Sustainable Business: Concept , Principles, drivers, Issues and opportunities of Business sustainability; Impact Investment (Global &Indian Scenario)

Module:3	Sustainable Business models	4 Hours

(a) Sustainable Value Framework by Prof . Stuart Hart (b) Creating Shared Value by Porter - Kramer ; application of the models

Module:4	Creating sustainable Business Models	5 Hours

Business Process Reengineering – (a) Use of Clean Technology and innovation; (b) Role of design and infrastructure – GREEN buildings and GREEN Certification; (c) Role of supply chain; (d) Operational aspects

Module:5	Creating sustainable Business Models	4 Hours

Being Customer centric: Drivers to adopt customer centric approach; Categories of Sustainable products; Customer Segmentation; Consumer behavior ; Communication sustainability; Sustainable consumerism

Module:6	**Creating sustainable Business Models**	**6 Hours**
Business Model Innovation – (a) creating end-to-end solutions to embed sustainability culture in organizations (b) Strategic Thinking **Emerging trends:** (a) Affordable innovation (b) Base of the Pyramid market (c) co-creation and collaboration		
Module:7	**Emerging trends**	**10 Hours**
(a) Ethnography based tools for market understanding (Bio-mimicry) (b)Socially responsible Investment (c) Social Enterprises **Sustainability Measurement and Reporting –** (a)EFQM Excellence model Framework (b) ESG Disclosure Framework (c) Stock market & Sustainable products (d)Sustainability reporting – GRI guidelines		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)	
1.	Nada R. Sanders, John D. (2014) Wood Foundations of Sustainable Business: Theory, Function, and Strategy, John Wiley & Sons, Inc
Reference Books	
1.	Eric Lowitt, (2011) The Future of Value: How Sustainability Creates Value Through Competitive Differentiation, John Wiley & Sons, Inc
2	Peter E Wells (2013), Business Models for Sustainability, Edward Elgar Publishing Ltd
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	
Project	
1.	Project — 60 hours
	Total Project — 60 hours

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course title	L	T	P	J	C
MGT1050	Software Engineering Management	2	0	0	4	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Understand the fundamentals of software engineering
2. Analysis the real time issues relating software.
3. Understand the trends and management relating to software

Expected Course Outcome: On the completion of this course the student will be able to:

1. Understand of the basic theoretical concepts of software Engineering.
2. Understand and connect the concepts with real time issues.
3. Understand real time issues, analyse it and find solutions
4. Understand certification and project management tools.
5. Develop software skills that enable them to handle them new trends in the area

Student Learning Outcomes (SLO): **: 1,2,3,5, 6,7,9,**

Module:1	**Introduction to software engineering**	**4 Hours**

Software process , Risk analysis, Professional and ethical responsibility

Module:2	**Requirements**	**4 Hours**

Requirement analysis, Specification and Prototyping

Module:3	**Prototyping and Design**	**4 Hours**

Architectural design, Real time design ,User inter face design and software prototyping

Module:4	**Development**	**4 Hours**

Fundamentals of coding, Software maintenance and software re -engineering

Module:5	**Verification and validations**	**4 Hours**

Testing, Phases and Types.

Module:6	**Software Quality Assurance**	**4 Hours**

Review, Walkthrough and inspect ion, Quality metrics, Software reliability

Module:7	**Software project management**	**3 Hours**

Project life cycle models: ISO 9001 model -Capability Maturity Model , Project planning, Project t racking, Project control Project closure.

Trends: Managing people, Software cost estimation ,Quality management , Process improvement and Change management

Module:8	**Contemporary issues:**	**2 Hours**

	Total Lecture		**30 hours**
Text Book(s)			
1.	Ali Behforooz and Frederick J. Hudson, 'Software Engineering Fundamentals, Oxford publications		
Reference Books			
1.	Roger Pressman. S., 'Software Engineering', A Practitioner's Approach, Tata McGraw Hill, New Delhi		
2	Pfleeger, 'Software Engineering', Prentice Hall, 1999		
3	Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli, 'Fundamentals of Software Engineering, Prentice all of India, 1991		
4	Richard Fairley, 'Software Engineering', II Edition, Tata McGraw Hill, New Delhi.		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Project			
1.	Project		60 hours
		Total Project	**60 hours**
Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

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Course code	Course title	L	T	P	J	C
MGT1051	Business Analytics for Engineers	2	1	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Apply mathematics and science in engineering applications
2. Computational thinking (Ability to translate vast data in to abstract concepts and to understand database reasoning)
3. Have cognitive load management skills

Expected Course Outcome: On the completion of this course the student will be able to:

1. Ability to identify the data characteristics and summarizing effectively.
2. Use of appropriate statistical tests for understanding the population.
3. Ability to illustrate the solutions offered through descriptive and inferential statistics.
4. Formulation and application of appropriate models of data analysis to aid effective decision making.
5. Detailed understanding and demonstration of supervised and unsupervised learning models.
6. Interpret and communicate the data analysis results effectively through reports

Student Learning Outcomes (SLO): **: 1,2,4,5,7,9,14,16,19**

Module:1	Data preparation	5 Hours

Types of Measurement, Data types, Measures of central tendency and dispersion and graphical representation for data summarization. Testing for normality, Power transformations, Outlier detect ion, missing values. Types of measurements.

Module:2	Causal and effect models	4 Hours

Simple and multiple correlation, causal models, simple and multiple regression, Heteroscedasticity, autocorrelation & Multicollinearity. Data screening & partitioning.

Module:3	Predictive analysis	4 Hours

Basic concepts of logistic regression - Logistic regression and contingency table analysis - Stepwise backward and forward methods logistic regression. Discriminant analysis. Comparison of logistic regression and discriminant analysis

Module:4	Model fit	5 Hours

Introduction-Types of errors, critical region, procedure of testing hypothesis – Large sample tests - Z test for Single Proportion, Difference of Proportion, mean and difference of means, F- test - chi -square test - goodness of fit - independence of at tributes

Module:5	Classification techniques	4 Hours

Factor Analysis: Data preparation, reduction of dimensionality. Cluster analysis: Classification methods - Deriving cluster and assessing overall fit

Module:6	**Data Mining**	**3 Hours**
Data Mining Concepts – Techniques and tools – Processes – Text Mining – Web Mining. Preparing the Data - Features Continuous, Ordered, discrete, categorical values - Interpreting the results		
Module:7	**Report writing**	**3 Hours**
Online Analytical Processing – Reports and Queries – Multidimensionality – Advanced Business analytics – Data Visualization – Geographical Information System – Real -time data analysis –– Web analytics – Benefits and Success of Business analytics.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**30 hours**

Text Book(s)	
1.	Turban, E., Sharda, R., & Delen, D. (2007). Decision support and business intelligence systems. Pearson Education India
Reference Books	
1.	Shmueli, G., Patel, N. R., & Bruce, P. C. (2007). Data mining for business intelligence: concepts, techniques, and applications in Microsoft Office Excel with XLMiner. John Wiley & Sons
2	Hair, J . F. , Black, W. C. , Babin, B. J. , Anderson, R. E. , &Tatham, R. (2006) . Multivariate Data Analysis: Pearson Education. New Jersey: Hoboken
3	Hami l ton, J. D. (1994) . Time series analysis (Vol . 2) . Princeton: Princeton university press
4	Hand, D. J. , Mannila, H. , & Smyth, P. (2001) . Principles of data mining. MIT Press

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
Tutorial		
1.	Tutorial	15 hours
	Total Tutorial	**15 hours**

Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

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Course code	Course title	L	T	P	J	C
MGT1052	Bottom of the Pyramid Operations	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives: To develop the ability to

1. Appraise the students on the Role of BOP model in solving the problem of low income group
2. Appraise the students with BOP based innovative business models
3. Appraise the students on how BOP enhance business value and social value

Expected Course Outcome: On the completion of this course the student will be able to:

1. Develop a win-win business model that would benefit poor and business
2. Understand the innovation process in the light of BOP
3. Familiarize intervention methods
4. Understand the BOP as an opportunity to serve under served
5. Understand the linkages between Social Entrepreneurship
6. Understand ecosystem for Wealth Creation

Student Learning Outcomes (SLO):	: 2,3,6,7,9,10,12,18

Module:1	Fundamentals of BoP	4 Hours

The concept of Bottom of the Pyramid (BoP) – Prahalad's views; contemporary adjustments

Module:2	Identification of the people at the bottom of pyramid as the world's most exciting	5 Hours

fastest-growing new market (both within the regional & global landscape); Nature of the market at the BoP level.

Module:3	Intervention Benefits	5 Hours

The Number and Nature of Opportunities; the developmental aspects; the philosophy of approaching the BoP markets

Module:4	Role of dignity and trust etc	5 Hours

Twelve Principles of Innovation for BOP Markets

Module:5	The Ecosystem for Wealth Creation	7 Hours

Market-Oriented Ecosystem; Addressing Inequalities; building capacity; managing network relationships; addressing grass-root governance issues- corruption, working with institutional inertia

Module:6	New Social Product Development	5 Hours

Designing a Social Product for Low- Income Markets- Process of New Social Product Development the appropriate Product Development Framework- Social Product Communication

Principles; Discussion of key success/failure cases		
Module:7	**Sustainable Innovation through Collaboration**	**12 Hours**
Sustainability Considerations and Triple-Helix approach-the FOCISS approach - Addressing the facilitators/obstacles. Innovative Practices at the Bottom of the Pyramid- Emerging Industry of Inclusive finance-Last mile technology experimentations.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)	
1.	Nada R. Sanders, John D. (2014) Wood Foundations of Sustainable Business: Theory, Function,and Strategy, John Wiley & Sons, Inc
Reference Books	
1.	Eric Lowitt, (2011) The Future of Value: How Sustainability Creates Value Through Competitive Differentiation, John Wiley & Sons, Inc
2	Peter E Wells (2013), Business Models for Sustainability, Edward Elgar Publishing Ltd

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	03-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

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Humanity Course syllabus

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Course Code	Course Title	L	T	P	J	C
CCA1002	Business Economics	3	0	0	0	3
Pre-requisite	NIL	Syllabus version				
		1.1				

Course Objectives:

1. To enable students to identify and explain economic concepts and theories related to the behaviour of economic agents, markets, industry and firm structures
2. To integrate theoretical knowledge with quantitative and qualitative evidence in order to explain past economic events and to formulate predictions on future ones.
3. To evaluate the consequences of economic activities and institutions for individual and social welfare

Course Outcomes:

Students will be able to:

1. Understand the discipline of business economics
2. Analyse how consumers and producers make decisions
3. Evaluate the production and pricing decisions of business firms
4. Understand the general principles of how the market economy functions
5. Develop the skills to use theories, models and graphs to analyse economic issues in business

Student Learning Outcomes (SLO):	2, 9, 11, 12

Module:1	Introduction	6 hours

Objectives and Scope of Business Economics -Demand Analysis: Consumer Equilibrium- Law of Diminishing Marginal Utility Theory – Law of Demand – Demand determinants.

Module:2	Elasticity of Demand	6 hours

Elasticity of Demand – Types – Importance of Elasticity of Demand in Management – Demand Forecasting.

Module:3	Supply Analysis	5 hours

Law of Supply – Elasticity of Supply – Factors influencing Supply.

Module:4	Production Analysis	6 hours

Producer's Behavior – Production Function – Law of Variable Proportion – Law of Returns to Scale.

Module:5	Cost Analysis	5 hours

Cost and Revenue Functions- Types – Short Run – Long Run – Areas of Cost Control.

Module:6	Break - Even Analysis	5 hours

Break-even Point – Determination of Break-even Point – Managerial uses of Break-even Analysis.

Module:7	**Market Structure & Pricing**	**6 hours**
Perfect, Imperfect, Monopolistic, Monopoly, Oligopoly Pricing- Role of Pricing in Market.		
Module:8	**Objectives of Business Firm**	**6 hours**
Sales or Revenue Maximization Theory- Objectives of Pricing Policy – Factors- Pricing Strategies: Skimming – Penetration Pricing.		
	Total Lecture Hours:	**45 hours**

Text Book(s)

1.	Pyndik & Rubinfied "Modern Micro Economics", Pearson Education, Seventh Edition, 2009.

Reference Books

1	Varian H.R., "Intermediate Microeconomics: A Modern Approach", East West Press Pvt., Ltd, New Delhi, Eighth Edition, 2015.
2.	Dominick Salvatore, Principles of Microeconomics, Oxford University Press, Fifth Edition, 2015.
3.	Paul Keat, Managerial Economics, Philip Young, Global Edition, 7th Edition, 2013.
4.	Joseph Nellis, David Parker , Principles of Business Economics, 2nd Edition, , Financial Times Prentice Hall Publisher, 2006.
5.	ManabAdhikary, Anurag , Business Economics, Jain Publishers, New Delhi, 2008.

Mode of Assessment: CAT / Assignment / Quiz / FAT

Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Course Code	Course Title	L	T	P	J	C
HUM1012	Introduction to Sociology	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1				

Course Objectives:

1. To develop awareness amongst students of sociological perspectives and sociological concepts
2. To introduce students to the basic social processes of society, social institutions and patterns of social behaviour
3. To help students to explore and understand sociology not merely as a social science discipline but as a distinctive branch of knowledge

Course Outcomes:

Students will be able to:

1. Define sociology as a discipline and explain how it is distinct from and related to other disciplines.
2. Demonstrate an understanding of the subject matter of the field of sociology, including the major concepts and vocabulary.
3. Explain the characteristics and functions of culture, socialization, groups and social processes.
4. Understand the structural distinctions of caste and class within social dynamics.
5. Analyze various social phenomena through the lens of sociological perspectives.

Student Learning Outcomes (SLO):	2, 9,11

Module:1	Sociology	6 hours

Definition – Nature – Field – Scope - Importance – Relationship with other social sciences

Module:2	Basic Concepts	6 hours

Society – Community – Association - Institution - Social Structure - Social System - Social Action – Role and Status

Module:3	Culture	5 hours

Meaning - Characteristics –Functions – Elements - Cultural Lag - Culture and Civilization

Module:4	Socialization	6 hours

Meaning - Socialization as a Process- Importance - Agents of Socialization–Adult Socialization.

Module:5	Social Groups	6 hours

Meaning – Importance - Types: Primary group and Secondary group - In-group and Out-group - Reference group

Module:6	Social Processes	6 hours

Associative processes (Cooperation, Accommodation, and Assimilation) - Dissociative processes

(Competition and Conflict)			
Module:7	**Social Stratification**		**6 hours**
Caste and Class - Changing Trends			
Module:8	**Invited Talk: Contemporary Issues**		**4 hours**
		Total Lecture hours:	**45 hours**
Text Book(s)			
1.	Bottomore, T B. (2010).**Sociology: A Guide to Problems and Literature**, Bombay, India: Routledge.		
Reference Books			
1.	Giddens, Anthony. (2013).***Sociology,***Delhi, India: Wiley.		
2.	Haralmbos, M.& Herald, R M. (2015).**Sociology: Themes And Perspectives**, New York, USA: Oxford University Pres.		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Seminar			
Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	No. 47	Date	05-10-2017

Course Code	Course	L	T	P	J	C
HUM1013	Population Studies	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1				

Course Objectives:

1. To develop a holistic understanding of demography
2. To provide a clear understanding of basic concepts and theories of population
3. To give students an opportunity to know about the various aspects of over population

Course Outcomes:

Students will be able to:

1. Familiarize themselves with the conceptual aspects of demographic composition of population
2. Understand the socio – cultural aspects of fertility and mortality
3. Critically analyze the issues of migration along with the implications of population growth and control on a global dimension
4. Comprehend and envisage the problems of over population
5. Perceive a broad understanding of the various factors of population

Student Learning Outcomes (SLO):	2, 9, 18

Module:1	Demography: Meaning	6 hours

Importance- Sources of demographic data: Census, Vital statistics, Sample surveys - Population theories: Malthusian theory and Demographic transition theory

Module:2	Fertility	6 hours

Fertility and fecundity - Socio-cultural factors affecting fertility

Module:3	Mortality	5 hours

Causes of mortality - Maternal mortality: Factors - Infant mortality: Causes and trends in India - Female infanticide – their implications

Module:4	Migration	6 hours

Types and patterns - Factors influencing migration - Social and demographic effects of migration - Brain gain and Brain drain trends

Module:5	Population Growth	6 hours

Trends of population growth in India and the world - Factors influencing population growth in India

Module:6	Population Control	6 hours

Need and measures of population control - India’s National Population Policy

Module:7	**Problems of over population**	**6 hours**
Water, housing, sanitation and health- Population Educations: Principles – Need – Importance- Agencies of Population Education		
Module:8	**Contemporary Issues**	**4 hours**
Guest Lectures by Industrial Experts		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Bhende, Asha A., and Kanitkar, Tara. (2017). **Principles of Population Studies**, Bombay, India: Himalaya Publishing House.
2.	Rai, A.K . (2016). **Population, development and Environment**, New Delhi, India: Manakin Press.
Reference Books	
1.	Anderton, D.L. &Yaukey. (2016). **Demography - Study of Human Population**, USA: Waveland Press.
2.	Baruah, A. (2011). **Population and Poverty**, New Delhi, India: VDM Verlag.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Seminar			
Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	No. 47	Date	05-10-2017

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Course Code	Course Title	L	T	P	J	C
HUM1022	Psychology in Everyday Life	2	0	0	4	3
Pre-requisite	Nil	Version				
		1				

Course Objectives:

1. To enhance the mental health and well-being of the individual
2. To enhance self-esteem, self- confidence, problem solving skill, and interpersonal communication skill
3. To understand one's strengths and weakness so as to reach self-actualization

Course Outcomes:

Students will be able to:

1. Improve adaptive thinking and adaptability of the students through scientific study
2. Understand the nature of self-concept and its importance for personal and social adjustment
3. Comprehend the fundamental processes of social perception and social cognition
4. Develop effective communication and reduce interpersonal conflict
5. Improve individual and group problem solving skills

Student Learning Outcomes (SLO):	3,4,12

Module:1	Adjustment:	2 hours

Meaning, factors of adjustment and causes of adjustment problems

Module:2	Concept of Self :	5 hours

Nature of self-concept, self-discrepancies, coping with self-discrepancies, factors shaping the self- concept- importance of self-esteem, development of self-esteem, building self-esteem. self-regulation: self- efficacy, developing self- efficacy, self- defeating behavior

Module:3	Social Perception and Social Cognition:	3 hours

Meaning – process – errors

Module:4	Communication and Conflict:	5 hours

Positive interpersonal climate, conversational skill, self-disclosure, effective listening, developing an assertive communication style - interpersonal conflict: types of conflict, styles of managing conflict, dealing constructively with conflict

Module:5	Group Dynamics	4 hours

Meaning of group –nature –types of groups – group problem solving

Module:6	Stress and Coping:	5 hours

Nature of stress, responding to stress, potential effects of stress – coping with stress: appraisal- focused strategies, problem-focused strategies, and emotion-focused strategies

Module:7	**Counselling and Psychotherapy**	**4 hours**
Meaning, nature, process and skills		
Module:8	**Contemporary Issues:**	**2 hours**
Guest lectures by industry experts		
	Total Lecture hours:	**30 hours**

Text Book(s)

1. Weiten,W., & Lloyed,M.A.(2007), "Psychology Applied to Modern Life: Adjustment in the 21st Century", 8th edition, Canada,Words worth.

Reference Books

1. Rathus,S.A.(1998), "Psychology Principles in Practice", Holt, Rinehart and Winston.
2. Myers, D.G.(2010), "Social Psychology", 10th edition, New York. NY: McGraw Hill Education.
3. Coon,D&Mitterer,J.O.(2007), "Introduction to Psychology: Gate ways to Mind and Behaviour", 11th edition, United States, Thomson Wordsworth.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Sample Project: Individual/ Group Project	**CO: 1,2,3,4,5**
1. Research projects on the topics adjustment, self-esteem, social perception, interpersonal communication, stress and Counselling	

Mode of evaluation: Review I, Review II and Review III

Recommended by Board of Studies	17-06-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

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Course code	Course title	L	T	P	J	C
HUM 1023	Indian Heritage and Culture	2	0	0	4	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives:

1. To help students to know more about India's rich heritage and culture and to make them learn the socio-economic, political and religious developments
2. To inspire students to appreciate and respect National leaders and instill in them values of patriotism and nationalism
3. To familiarize students with brief background of heritage tourism and development with special reference to India

Course Outcomes:

Students will be able to:

1. Understand the meaning of culture and heritage and the factors which contributed to the making of our culture
2. Understand the glory of Indian history
3. Understand how the Indian culture evolved over the centuries of history and what the landmarks are of the development of our culture and what their identifying features are
4. Understand about the colonialism and anti-colonial struggles and also identify the importance and legacy of the freedom movement
5. Understand the culture, heritage and its relationships with tourism

Student Learning Outcomes (SLO):	2, 9, 11, 12

Module:1	Making of Indian Civil Society:	4 hours

Evolution of early man: Ethnicity-Tribal life – Cultural contribution of Indus Valley Civilization – Ancient Educational System: Impact and Relevance – Development of Science, Technology and Medicine: Individual contributions

Module:2	Impact of Ancient Religious sects:	3 hours

A survey of Buddhism- Jainism – Hinduism

Module:3	Harmony - Anchor sheet of Indian Culture	4 hours

Ashoka – Impact of Bakthi Movement – Religious Harmony of Mughals – Composite Culture.

Module:4	Cultural Contributions:	5 hours

Pallava - Chola – Chalukya - Kakathiya- Vijayanagara Empires

Module:5	Colonialism and Anti – Colonial struggles:	4 hours

Stages of colonialism and its impact – Popular Resistance to Company's Rule –Impact of 1857 Revolt and beyond

Module:6	Emergence and repercussions of Indian Nationalism:	**5 hours**
Socio - Religious Reform Activities - Role of Pre – Gandhian Movements – Nationalist Activism – Attainment of Independence		
Module:7	Culture, Heritage and Tourism:	**3 hours**
Comparison and Contrast with Other cultures of the world – Case studies of UNESCO Heritage Sites and its impact on International Tourism		
Module:8	**Contemporary issues:**	**2 hours**
Guest Lectures by Experts		
	Total Lecture hours:	**30 hours**
Sample Projects:		

1. A survey of ancient temples, forts and sites in and around Vellore
2. Conduct a review study on recent archaeological excavations in India or abroad
3. Research on controversial incidents in Indian history.
4. Research on ethical values hidden in Indian ancient scriptures.
5. A research on the origin and importance of food, custom, tradition, festival, value and attire in the Indian context.

Text Book:

1. Majumdar, R.C., Rayachauduri, H.C. and Datta, K., An Advanced History of India, Mac Millan India Ltd., New Delhi.

Reference Books

1.	Chandra, B., History of Modern India, 1st Edition, Orient Blackswan.
2.	Mehrotra S.R., The Emergence of the Indian National Congress, Reprint, New Delhi: Rupa.
3.	Thapar, R., The Penguin History of Early India: From The Origins To AD 1300, 1st Edition, Penguin Publisher.
4.	Smith, V. A. and Spear, P. (ed.), The Oxford History of India, Oxford.
5	Timothy, D. J. (2011), Cultural Heritage and Tourism, Channel View Publications. E-Resources and History Blogs

Mode of Evaluation: Quizzes, CAT, Digital assignments, poster/collage making and projects

Recommended by Board of Studies	30-05-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

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Course code	Course title	L	T	P	J	C
HUM1024	India and the Contemporary World	2	0	0	4	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives:

1. To understand India's bilateral relationships and countries role in global economic, security and political regimes
2. To understand the central realities, issues and developments pertaining to India's foreign policy at the bilateral, regional and global levels and to understand the dynamics of multi-cultural society
3. To understand and update knowledge on contemporary/current issues and challenges at global level

Course Outcomes:

Students will be able to:

1. Demonstrate a broad and deep understanding of foreign policy / international relations
2. Explain social and political institutions (regional, global and multilateral levels) and processes across the world
3. Understand the major issues and problems of contemporary Indian society and the relevant links between the past and present key issues in today's world
4. Understand the opportunities and core controversies between India and other countries in south Asia
5. Be aware of the major challenges facing the country in the 21st century

Student Learning Outcomes (SLO):	2,9,11,12

Module:1	India's International Relations:	4 hours

A Historical Perspective Domestic and International requirements of India's Foreign Policy - Objectives and Principles- Non-Alignment: Concepts, Policy and Relevance

Module:2	India and the Global Economic and Political Scenario	4 hours

India and World Trade Organisation (WTO) - India at the United Nations: Security Council Reforms

Module:3	Emerging Asia and the Role of India	3 hours

Module:4	India and South Asia:	3 hours

India and South Asia: Opportunities and Challenges Pakistan, Afghanistan, Sri Lanka, Bangladesh, Nepal, Bhutan and Maldives

Module:5	Human Resources, Development and International Competence:	5 hours

Indices Related.

Module:6	India's Multilateral Engagement	**4 hours**
BRICS - European Union (EU) – East Asia Summit(EAS) - Association of South East Asian Nations (ASEAN) - South Asian Association for Regional Cooperation (SAARC)		
Module:7	India's Domestic Issues	**5 hours**
Poverty, Education, Health, Terrorism, Energy and Food Security		
Module:8	**Contemporary issues:**	**2 hours**
Guest lectures by Experts		
	Total Lecture hours:	**30 hours**

Sample Projects:

1. A survey of India's Free Trade Agreements with other nations.
2. A study on Indian Diaspora.
3. Conduct a review study on India's bilateral and multilateral cooperation.
4. Review report on opportunities and challenges of international students.
5. A survey on growing significance of service sector and higher education in developing economies.

Reference Books

1.	Ghosh, A. et. al. (eds.), India's foreign policy. New Delhi: Pearson.
2	Pant, H.V. (ed.), India's foreign policy in a Unipolar World. New Delhi: Routledge.
3	Behera, N.C. (ed.), International Relations in South Asia: Search for an Alternative Paradigm. New Delhi: Sage.
4	Abhayankar, R.M., Indian Foreign Policy. New Delhi: Foreign Service Institute
5	Walter, C., Thomas, R., and Beth, AS., Hand Book of International Relations, Sage Publications, London

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Recommended by Board of Studies	30-05-2016		
Approved by Academic Council	No. 41	Date	17.06.2016

Vellore Institute of Technology
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Course code	Course title	L	T	P	J	C
HUM1025	INDIAN CLASSICAL MUSIC	1	0	2	4	3
Pre-requisite	NIL	Syllabus version				
		2				

Course Objectives:

1. Bring in awareness of Music and understand the basics.
2. Appreciation of Music, identification of the Ragas and the Talas.
3. Developing skill to sing different types of Music.

Expected Course Outcome:

1. Acquiring basic knowledge on sound, music and history of Indian Music.
2. Gain knowledge in the structure of Hindustani Music and Carnatic Music and the musical forms in both styles.
3. Awareness about different aspects in music.
4. Knowledge in different genres of music.
5. To know the scientific aspects of music.

Student Learning Outcomes (SLO):	2, 3, 11, 13		
Module:1	**Title** Introduction to Music	**2 hours**	
Module content			
Sound-Music-Rhythm- Performance-Listeners and Performers.			
Module:2	**Title** History of Indian Classical	**2 hours**	
Module content Music Introduction to Different Genres of Music-Indian Classical (Hindustani and Carnatic), Western Classical Music, Folk etc.			
Module:3	**Title** Carnatic Classical Music	**2 hours**	
Module content Nadam-Swaram-Sruthi-Ragam- Basic Tala Exercises of Carnatic Music-Compositions (Geetham, Swarajathi, Varnam, Keerthanam, Krithi)-Popular Figures in Carnatic Music.			
Module:4	**Title** Hindustani Music	**2 hours**	
Module content Origin-Evolution-Compositions (Khayal, Dhrupad, Thumri, Thappa, Tharana)-Ten Dhats ,Major Gharanas in Hindustani Music-Popular Figures in Hindustani Music			
Module:5	**Title** Film Music.	**2 hours**	
Module content Contemporary music, Western music, Background Music-Composing.			
Module:6	**Title** Science and music -science in music	**2 hours**	
Module content Music and Mind- Emotions-Conditioning-Teaching Therapeutic Effects of Music,			
Module:7	**Title** Music as a profession	**2 hours**	
Module content Concert Platforms, Different Types of Shows, emotional connect, mood music			

Module:8	**Contemporary issues**	**2 hours**	
	Total Lecture hours:	**16 hours**	

Sample projects

1. Music composing: compose a song in any language with back ground music and original music score .it can be in any genre.
2. Group song: learn a thematic song preferably a patriotic song, rehearse and record it in a professional studio and submit.
3. Give a public performance with the team members and shoot the video with audio and submit. Minimum 5 songs should be performed.

	Text Book(s)
1.	No text book
Reference Books	
	1 Ganamrutha Bodhini By A S Panchapakesa Iyer. 2. The splendor of south Indian music Dr P T Chelladurai. 3. South Indian Music – Volume I – Prof. Dr. P. Sambamoorthi – Indian Music Publishing House 4. Raganidhi – Dr. Subbarao - Music Academy, Chennai. 5. Music through ages Dr Premlatha Sharma.

Mode of Evaluation: CAT / Assignment / FAT / Project

List of Challenging Experiments (Indicative)		
1.	Compositions: Sarali varisais dhatu varisais and alankaras.	2 hours
2.	Compositions: Small kirthanas 2.note swaras.	2 hours
3.	Compositions: Two geethams one swarajathi	2 hours
4.	Compositions: Two songs from different languages tamil, Telugu and two simple krithis in any language.	2 hours
5.	Two songs from different languages kannada and Malayalam	2 hours
6	Thukkadas (any two out of the followings thevaram thirupugazh hindi bhajans,abhang ,thillana patriotic songs etc)	3 hours
	Total Laboratory Hours	13 hours

Mode of evaluation: lab experiments and fat lab

Recommended by Board of Studies	17-06-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

Course Code:	Course Title	L	T	P	J	C
HUM1033	Micro Economics	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.1				

Course Objectives:

1. To enable students to identify and explain economic concepts and theories related to the behaviour of economic agents, markets, industry and firm structures
2. To integrate theoretical knowledge with quantitative and qualitative evidence in order to explain past economic events and to formulate predictions on future ones
3. To evaluate the consequences of economic activities and institutions for individual and social welfare

Course Outcome:

Students will be able to:

1. Understand the discipline of microeconomics
2. Cognize the general principles of how the market economy functions
3. Analyze how consumers and producers make decisions and learn about different market structures
4. Identify the consumption decision of households, hiring and investment decisions of the firms
5. Develop the skills to use theories, models, and graphs to analyze national and international case studies

Student Learning Outcomes (SLO):	2, 9, 11, 12

Module:1	Introduction to Micro Economics	6 hours

Subject matter of economics; Micro versus Macroeconomics, Positive versus Normative Approaches; Arts versus Science.

Module:2	Theory of Consumer Behavior	6 hours

Utility - Ordinal versus Cardinal- Law of Diminishing Marginal Utility - Consumer equilibrium - Demand: Law of Demand – determinants of demand – movement and shift in Demand; exception to law of demand; Law of supply – Market equilibrium.

Module:3	Elasticity of Demand and Supply	5 hours

Elasticity of Demand: price, income and cross – Price elasticities; measurement of elasticity – Elasticity of supply.

Module:4	Theory of Production	6 hours

Production - Production Function: Single input and Multiple input cases– Features of Production - Law of Variable Proportion – Law of Returns to Scale – input elasticity – Isoquant and Isocost line - Producer Equilibrium.

Module:5	Theory of Cost and Revenue	6 hours

Cost Functions - Types – Short Run – Long Run cost curves - relationship between AC and MC - Revenue Functions – Types – Relationship between AR and MR.		
Module:6	**Market Structure 1**	**6 hours**
Perfect competition – Characteristics – Price Competitive Strategies.		
Module:7	**Market Structure 2**	**6 hours**
Imperfect Competition – Monopolistic Competition – Monopoly – Oligopoly – Non–Price Competitive Strategies.		
Module:8	**Contemporary Issues:**	**4 hours**
Guest Lectures by Industrial Experts		
	Total Lecture Hours:	**45 hours**

Text Book(s)	
1.	Varian H.R. (2015), "Intermediate Microeconomics: A Modern Approach", East West Press Pvt., Ltd, New Delhi, Eighth Edition.
Reference Books	
1.	Salvatore, D (2015), "Principles of Microeconomics", Oxford University Press, UK, Fifth Edition
2.	Keat, P, Young, P and Erfle, S.E (2013) , "Managerial Economics", Pearson Higher Education, USA, Seventh Edition.
3.	Salvatore, D. (2015), "Principles of Microeconomics", Oxford University Press, UK, Fifth Edition.
4.	Dorman, P (2014), "Microeconomics – A Fresh Start", Springer, Germany, First Edition.
5.	Nicholson, W and Snyder, C (2014), "Microeconomic Theory, Basic Principles and Extensions", Cengage Learning, USA, Eleventh Edition.

Mode of Assessment : CAT, Quiz , Digital Assignments and FAT			
Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	No. 47	Date	05-10-2017

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Course Code:	Course Title	L	T	P	J	C
HUM1034	Macro Economics	3	0	0	0	3
Pre-requisite	Nil	Syllabus Version				
		1.1				

Course Objectives:

1. To enable students to identify the determinants of various macroeconomic aggregates such as output, unemployment, inflation, productivity and the major challenges associated with the measurement of these aggregates
2. To discuss the linkages between financial markets and the real economy and how these linkages influence the impact of economic policies over differing time horizons
3. Enable students to critically evaluate the consequences of basic macroeconomic policy options under differing economic conditions within a business cycle

Course Outcomes:

Students will be able to:

1. Familiarize themselves with the discipline of macroeconomics
2. To understand the general principles of consumption function and how an economy functions in a global environment
3. Learn macroeconomics concepts such as growth and inflation
4. Explain the ways in which the government and central bank can influence the economy and the markets through fiscal and monetary policies
5. Develop the skills to use theories of multiplier and accelerator models to analyze everyday problems in real world situations and evaluate economic policies

Student Learning Outcomes (SLO):	2, 9, 11, 12

Module:1	Introduction to Macroeconomics	6 hours

Meaning and subject matter of macroeconomics – Macroeconomic issues – Importance of Macroeconomics – Macroeconomic Aggregates.

Module:2	National Income	6 hours

Circular flow of income, National income: Meaning, - Concepts – Nominal and real income - Methods of measurement – Importance – Problems in measurement.

Module:3	Theory of Income and Employment Determination	5 hours

Unemployment: Meaning – Causes - Consequences - Classical theory of Employment – Keynesian theory of Employment – Government Expenditure and Fiscal Policy.

Module:4	Consumption Function	6 hours

Consumption: Meaning - Components – Determinants - Consumption function: Meaning – Kinds - Investment: Meaning - Components – Determinants - Investment function: Meaning – Kinds – Application.

Module:5	**Theory of Multiplier and Accelerator**	**6 hours**
Multiplier: Meaning – Working of multiplier – Accelerator: meaning – Working of accelerator – Super multiplier.		
Module:6	**Inflation and Deflation**	**6 hours**
Inflation: Meaning - Types - Causes – Philips curve - Deflation: Meaning – Causes – Consequences.		
Module:7	**Money Market**	**6 hours**
Demand and Supply of money **–** Monetary policy: meaning – Objectives - Variables.		
Module:8	Contemporary Issues	**4 hours**
Guest Lectures by Industrial Experts		
	Total Lecture Hours :	**45 hours**

Text Book(s)

1. Mankiw, G. (2010), Macroeconomics, Worth Publishers, 7th edition.

Reference Books

1. Dwivedi, D. N. (2008), Macroeconomics Theory and Policy, Tata Mcgraw – Hilll Publishing Company Limited, New Delhi.
2. Jhingan, M .L. (2010), Macroeconomic Theory, Konark Publishers Pvt. Ltd.
3. Blanchard, O. (2006), Macroeconomics, Pearson Education Inc.
4. Nellis, J. and Parker, J.D. (2004), Principles of Macro Economics, 2nd Edition, Financial Times Prentice Hall Publisher.
5. Shapiro, E. (2009), Macro Economic Analysis, Prentice Hall of India.

Mode of Assessment : CAT, Quiz , Digital Assignments and FAT			
Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	No. 47	Date	05-10-2017

Course Code	Course Title	L	T	P	J	C
HUM1035	Introductory Econometrics - Theory	2	0	2	0	3
Pre-requisite	Nil	Syllabus Version				
		1.1				

Course Objectives:

1. To introduce the basic concepts of econometrics
2. To familiarize the students with econometrics methodology
3. To use appropriate econometrics tools based on data sets

Course Outcomes:

Students will be able to:

1. Understand the econometrics methodology and familiarize themselves with the assumptions underlying the CLRM
2. Apply multiple regression model and test hypothesis
3. Practice remedial measures for violation of CLRM assumptions
4. Understand the use of dummy variables in regression model and apply the same
5. Convert the non-stationary time series into stationary time series

Student Learning Outcomes (SLO):	2,9,11,12

Module:1	Introduction	3 hours

Introduction to Econometrics – Econometric Model Building – Types and Sources of Data – Population Regression Function and Sample Regression Function – Significance of error term.

Module:2	Simple Regression	3 hours

Two variable model – Assumptions - Estimation of Regression Coefficients - BLUE Property — Goodness of Fit – Correlation Vs Regression.

Module:3	Hypothesis Testing, Functional Forms and Specification Test	4 hours

Confidence Intervals and test of significance approaches (T- test) – Regression Forecasting – Functional forms - Omission of a relevant variable - Inclusion of irrelevant variable.

Module:4	Multiple Regression Analysis	4 hours

Three variables model – Estimation, Adjusted R^2, Partial Regression and Partial Correlation – Multiple Regression – Applications.

Module:5	Violations of Classical Assumptions and Remedies	6 hours

Multicollinearity, Heteroscedasticity and Auto-correlation.

Module:6	Dummy Variables	4 hours

Types of dummy variables – Applications of dummy variables – Dummy variable trap – Chow test – Dummy interaction effect – Structural Shift.		
Module:7	**Introduction to Time Series Models**	**4 hours**
Stationarity Vs. Non- Stationarity – Random walk and Unit root test – ARIMA model.		
Module:8	**Contemporary Issues:**	**2 hours**
Guest lectures by Industrial experts		
	Total Lecture Hours:	**30 hours**

Text Book(s)

1.	Chris Brooks (2008), Introductory Econometrics for Finance, Cambridge University Press, Second Edition.

Reference Books

1.	Gujarati N Damodar, Dawn C Porter, and Sangeetha Gunasekar (2012), "Basic Econometrics", Tata McGraw Hill Ed Private Ltd, Fifth Edition.
2.	Dougherty, Christopher (2011), "Introduction to Econometrics", Oxford University Press, Fourth Edition.
3.	Pindyck, S Robert and Daniel L Rubinfeld (1998), "Econometric Models and Economic Forecasts", McGraw Hill International, Fourth Edition.

Mode of Assessment: CAT / Assignment / Quiz / FAT			
Recommended by Board of Studies	25-07-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

Vellore Institute of Technology
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Course Code	Course Title	L	T	P	J	C
HUM1035	Introductory Econometrics - Lab	2	0	2	0	3
Pre-requisite	Nil	Syllabus version				

Course Objectives:

- To introduce the basic concepts of Econometrics in Social Sciences Research – Theories and tools of Econometrics in Social Sciences Research.

Expected Course Outcome:

- Students should be aware of basic concepts of econometrics and theoretical significance in Social Sciences Research.

Student Learning Outcomes (SLO):	2, 10, 11, 12

Module:1	Introduction to Econometrics	2 hours

Specification tests: Ommission of relevant variables - Inclusion of unnecessary variables - Adopting the wrong functional form - Error of measurement.

Module:2	Simple Regression	3 hours

Using SPSS, E-Views & R Softwares.

Module:3	Hypothesis Testing and Functional Forms	4 hours

Functional Forms : Measure the Elasticity - The log linear model. Measure the growth rate: Log in model - Lin-log model.

Module:4	Multiple Regression Analysis	3 hours

Using SPSS, E-Views & R Softwares.

Module:5	Violation of Classical Assumptions and Remedies	6 hours

Identification of Multicollinearity and its Remedy - Testing for Heteroscedasticity and Weighted Least Squares - Testing for Autocorrelation.

Module:6	Dummy Variables	2 hours

Dummy Variable - Structural Break Analysis

Module:7	**Introduction to Time Series Model**	**8 hours**
Time series trend analysis - Unit root test: Augmented Dickey Fuller test - With trend and Without trend - Correlogram (Auto and Partial) and Q statistics - ARIMA model and Forecasting - ARMA model and Forecasting.		
Module:8	**Invited Talk:** Contemporary Issues	**2 hours**
	Total Lecture Hours:	**30 hours**

Text Book(s)

1.	Chris Brooks (2008), Introductory Econometrics for Finance, Cambridge University Press, Second Edition.

Reference Books

1.	Gujarati N Damodar, Dawn C Porter, and Sangeetha Gunasekar (2012), "Basic Econometrics", Tata McGraw Hill Ed Private Ltd, Fifth Edition.
2.	Dougherty, Christopher (2011), "Introduction to Econometrics", Oxford University Press, Fourth Edition.
3.	Pindyck, S Robert and Daniel L Rubinfeld (1998), "Econometric Models and Economic Forecasts", McGraw Hill International, Fourth Edition.

Mode of Assessment: CAT / Assignment / Quiz / FAT

List of Experiments	
1. Experiment of Specification Test	2
2. Experiment of Simple Regression	3
3. Experiment of Hypothesis Testing and Functional Forms	4
4. Experiment of Multiple Regression	3

5. Experiment of Violations of Classical Assumptions and Remedies	6
6. Experiment of Dummy Variables	2
7. Experiment of Time Series Models	10
Total Laboratory Hours:	**30**

Mode of Assessment : Internal Experiments/Lab FAT

Recommended by Board of Studies	25-07-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

VIT®
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Course Code	Course Title	L	T	P	J	C
HUM1036	Engineering Economics and Decision Analysis	2	0	0	4	3
Pre-requisite	Nil	Syllabus Version				
		1.1				

Course Objectives:

1. To introduce the basic concepts of economics in engineering decision making – theories and tools of economics in engineering applications
2. To analyze cost/revenue data and carry out economic analyses to justify or reject alternatives/projects on an economic basis
3. To understand the macroeconomic influences such as inflation on engineering decision making

Course Outcomes:

Student will be able to:

1. Understand the basic principles of engineering economics
2. Evaluate the methods of cost estimation and to estimate present and future values of cash flows
3. Analyze the impact of inflation in decision making
4. Identify project appraisal techniques and depreciation methods and their impact on taxation
5. Make decisions with or without probabilities

Student Learning Outcomes (SLO):	2, 9, 11, 12

Module:1	Introduction	4 hours

Engineering Economics and Decision Making - Engineering Efficiency - Economic decisions– Concepts of value and Utility.

Module:2	Cost Estimation	4 hours

Cost Concepts- Life Cycle Costing - Cost Estimation Techniques.

Module:3	Economic Decision Analysis	4 hours

Cash flows – Present Value of Future Cash flows – Discounting factor – Cost of capital.

Module:4	**Inflation**	**4 hours**
Inflation – Inflation Rate – Impact of Inflation. – Incorporating Inflation in Decision making.		
Module:5	**Project Appraisal Techniques**	**3 hours**
Calculation of Economic Equivalence –. Capital Budgeting Process – Evaluation of Alternatives – Techniques of Evaluation – Cost- Benefit Analysis.		
Module:6	**Depreciation**	**4 hours**
Depreciation – Introduction, Basic Depreciation Methods - Depreciation and Taxes in India. Replacement Analysis.		
Module:7	**Decision Analysis**	**5 hours**
Decision Making Process – Decision Making without Probabilities – Decision Making with Probabilities. Risk Analysis and Sensitivity Analysis – Decision Trees.		
Module:8	**Contemporary Issues:**	**2 hours**
Guest lectures by Industrial Experts		
	Total Lecture Hours:	**30 hours**

Text Book(s)

1. Sullivan G William, Elin M Wicks and C. Patrick Koelling (2011), "Engineering Economy", Pearson Education, 14th Edition.

Reference Books

1. Blank, Leland and Anthony Tarquin (2012), "Engineering Economy", Tata Mc Graw Hill, Seventh Edition.
2. Henry Malcolm Steiner (2003), "Engineering Economic Principles", Tata Mc Graw Hill, New Delhi, Second Edition.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project

Sample Projects

1. Analyzing the cost data of a company 2. Analyzing the project evaluation techniques followed by companies 3. Analyzing the inflation rates of a specific country during a time period 4. Estimating the cost of a product/project at its specific lifecycle stage			
Mode of Assessment: Review - I, Review - II and Review - III.			
Recommended by Board of Studies	25-07-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

Course Code	Course Title	L	T	P	J	C
HUM 1037	Applied Game Theory	2	0	0	4	3
Pre-requisite	NIL	Syllabus version				
		1.1				

Course Objectives:

1. To understand the game theory concepts and their applications in economics
2. To enable students develop decision making skills with available information
3. To integrate theoretical knowledge on game theory with applications in their chosen engineering domain

Course Outcomes:

Students will be able to:

1. Understand the basic concepts in game theory
2. Find Nash equilibrium in a game
3. Understand games with perfect information
4. Understand games with imperfect information
5. Comprehend the applications of game theory

Student Learning Outcomes (SLO):	2, 9, 11, 12

Module:1	Introduction	4 hours

Introduction to Game theory – The theory of rational choice- Interacting decision – makers

Module:2	Games with Perfect Information	4 hours

Nash Equilibrium and its illustrations – Cournot's model of oligopoly – Bertrand's model of oligopoly- Auctions - Dominated Actions – Games with symmetric equilibrium

Module:3	Mixed Strategy Equilibrium	4 hours

Expected pay off functions – Strategic games - Randomization - Illustrations

Module:4	Extensive Games with Perfect Information	4 hours

Strategies and outcomes – Sub game perfect equilibrium – Stackelberg's model of duopoly

Module:5	Games with Imperfect Information	4 hours

Bayesian games – Cournot's duopoly game with imperfect information – Auctions

Module:6	Extensive Games with Imperfect Information	4 hours

Strategies – Sequential Equilibrium – Signaling Games

Module:7	**Repeated Games**	**4 hours**
The Prisoners' Dilemma		
Module:8	**Contemporary Issues:**	**2 hours**
Guest Lecture by Industrial Experts		
	Total Lecture hours:	**30 hours**

Text Book

1.	Osborne J. Martin (2009), An Introduction to Game Theory, Oxford University Press, Indian Edition.

Reference Books

1.	Dixit K Avinash and Barry J. Nalebuff (2010), Thinking Strategically. The Competitive Edge in Business, Politics and Everyday Life, Viva Books, First Indian Edition.
2	Watson, Joel (2010), Strategy: An Introduction to Game Theory, Viva Books, Second Edition.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Presentations

Sample Projects

1.Game Theory Model Development(Group Project)

2.Analysis of Research Papers from reputed journals on Game Theory and extending them. (Group Project)

Mode of Assessment: Review – I, II, III

Recommended by Board of Studies	27-05-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

Course Code	Course Title	L	T	P	J	C
HUM1038	International Economics	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.1				

Course Objectives:

1. To understand trade-related concepts and their applications in international trade
2. To understand the importance and role of foreign capital and foreign exchange for the economic development of countries
3. To understand trade-related issues faced by the economies and their solutions

Course Outcomes:

Students will be able to:

1. Understand the discipline of international economics through concepts and theories and understand how trade takes place among countries under different environment
2. Learn the importance of foreign capital in the economic progress of nations
3. Understand the ways in which exchange rate is determined and its effect and also the importance of foreign exchange reserve to solve economic issues
4. Apply economic and trade policies to strengthen the trade relationship and to regulate and control international trade
5. Acquire the ability to understand the importance of balance of payment and balance of trade and its impact on the economy

Student Learning Outcomes (SLO):	2, 9, 11

Module:1	International Economy	4 Hours

Meaning and Scope – Categories of economies - Factors promoting global economic integration - New Economic policy – Issues.

Module:2	Trade Theories	4 Hours

Theory of Comparative Advantage – Leontief Paradox - Hicksian theory of trade – Factor endowment – Heckscher-Ohlin Theorem of International Trade.

Module:3	Global Sourcing of Capital Flows:	5 Hours

Forms of capital flows: Foreign Direct Investment (FDI) & Foreign Portfolio Investment (FPI) –

FDI in Retailing - Role of global financing institutions (World bank, International Monetary Fund, Asian Development Bank, United Nations Conference on Trade and Development) - Liberalisation of trade – World Trade Organisation initiatives.		
Module:4	**Exchange Rate**	**4 Hours**
Determination – Effects- Exchange rate regime: Fixed, Flexible, Floating rates (1971-now) – Methods of foreign payments – Issues in Foreign exchange reserves.		
Module:5	**Trade**:	**4 Hours**
Tariffs, Quotas and other trade restrictions - classifications of tariffs - Impact of tariff - Types of quotas - Custom duty on trade.		
Module:6	**Foreign Trade Promotion**	**4 Hours**
Trade policy as an instrument – Export Oriented Units (EOUs), Special Economic Zones (SEZs) – Import Substitution.		
Module:7	**Balance of Trade & Balance of Payments**:	**3 Hours**
Current & Capital account – Balance of payments disequilibrium: Economic, Social & Political factors - Financing of Balance of Payment deficit.		
Module:8	**Contemporary Issues:**	**2 Hours**
Guest lectures by Industrial experts		
	Total Lecture Hours:	**30 Hours**

Text Book(s)	
1.	Francis Cherunilam, International Economics (2013), 5th Edition, Tata MC Graw Hill Companies, New Delhi.
Reference Books	
1.	Robert C. Feenstra, Advanced International Trade: Theory and Evidence (2016), Second Edition, Princeton University Press, USA.

2.	Paul R. Krugman, Maurice Obstfild and Marc J. Melitz, International Economics, Theory and Policy (2017), 11th Edition, Princeton University Press, USA.		
Mode of Assessment : CAT / Assignment / Quiz / FAT			
Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	No. 47	Date	05-10-2017

Course Code	Course Title	L	T	P	J	C
HUM1039	Community Development in India	2	0	0	4	3
Pre-requisite	Nil	Syllabus version				
		1				

Course Objectives:

1. To enable students to understand the unique nature of rural and urban community
2. To develop sensitivity and communication for working with rural and urban poor
3. To provide knowledge on government and voluntary initiatives for rural and urban development

Course Outcomes:

Student will be able to:

1. Gain greater insights into the concepts and approaches of community development
2. Provide a comprehensive understanding of rural community and structure and functions of local self- governance with reference to its policy implications
3. Understanding the core agencies involving in the development of rural community and the disparities between rural and urban communities with reference to various problems
4. Familiarise themselves with the urban structures of governance
5. Enhance awareness of the significance of government schemes implemented for urban development and learning through stakeholders in community development practice

Student Learning Outcomes (SLO):	2,9,11

Module:1	Community Development:	4 hours

Meaning – Objectives – Approaches – Early Experiments and Lessons learnt

Module:2	Rural Community Development:	4 hours

Rural backwardness - Causes - Need for planned change – Objectives - Five-year plans - Major Government programs – Success and Failures

Module:3	Panchayat Raj and Community Development:	5 hours

Meaning - Origin – Objectives – Structure – Functions – Constitution – 73rd Amendment and its Implications

Module:4	Agencies of Rural Development:	3 hours

Rural Cooperatives - Non-Governmental Organizations - Self-Help Groups in Rural Community Development

Module:5	Rural and Urban Community Issues:	4 hours

Housing - Water - Sanitation – Unemployment- Health and Education - Rural - Urban Poverty

Module:6	Urban Administrative Structure and Governance:	4 hours

Town Panchayat – Municipalities – Corporations - Metropolitan Development Authorities - Housing and Urban Development Corporation (HUDCO) - Slum Clearance Board

Module:7	**Urban Development Programs:**	**4 hours**
Five-year plans and Urban Development - Tamil Nadu Urban Development Project (TNUDP) - Urban Basic Services Programs (UBSP) - Nehru RozgarYojana (NRY) - Tamil Nadu Slum Area Clearance and Improvement – Urban Renewal Programme – Emergence of Smart Cities		
Module:8	Interaction with Social Activists, Economists and Sociologists	**2 hours**
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Pillai P Gopinadhan , Rural Development in India, Pointer Publishers, New Delhi.
2	R Ramachandran, Urbanization and Urban Systems in India, Oxford University Press.
Reference Books	
1	K.C. Sivaramakrishnan, A. Kundu and B.N. Singh (2007), "Handbook of Urbanization in India", Oxford University Press, New Delhi.
2	Rao, VLS P, "Urbanization in India", Concept Publishing Company, New Delhi
3	Kasambi M. (1994), "Urbanization and Urban Development in India", ICSSR, New Delhi.
4	Singh, K. (1986), "Rural Development: Principles, Policies and Management", New Delhi,Sage Publication.
5	Desai, V. (1988), "Rural Development", Vols. 1 & 4, Himalaya Publishing House, Bombay.
6	Ministry of Rural Development, Annual Report 2011-12.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
Sample Projects:		**15hours**
1	Research Projects on rural poverty issues in India.	**15hours**
2	Research projects on structure and functions of PanchayatRaj in India.	**15hours**
3	Research projects on role of NGOs and SHGs in community development.	**15hours**
4	Case studies on slums and crimes in urban areas.	**15hours**
5	Research projects on impacts of urban development programs on beneficiaries.	**15hours**
Mode of Evaluation : Review-I, II, III		

Recommended by Board of Studies	26-05-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

Vellore Institute of Technology
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Course Code :	Course Title	L	T	P	J	C
HUM1040	Indian Social Problems	3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.1				

Course Objectives:

1. To create awareness amongst students about various social issues prevailing in India
2. To study the various state and central level programmes related to social and economic issues in India
3. To develop a broad understanding of the persistence of stratification in contemporary Indian society

Course Outcomes:

Students will be able to:

1. Be familiar with the conceptual aspects of socio-economic problems that leads to social issues in Indian society
2. Clarify how over population perpetuates different social problems in India.
3. Able to analyse the stratifications of Indian society in terms of communalism and its problems
4. Explore the prevalence of human trafficking in Indian society
5. Understand gender dynamics in the context of India with respect to inequality, child abuse, child labour and violence against women

Student Learning Outcomes (SLO):	2, 9, 11

Module:1	Social Problems:	6 hours

Meaning – Characteristics – Types - Stages in the development of social problems

Module:2	Economic Problems:	6 hours

Poverty: Meaning – Causes - Central and State poverty alleviation programs. Unemployment: Meaning –Types – Causes - Measures to control unemployment

Module:3	Population Problems:	5 hours

Meaning – Causes - Consequences - Measures to control population problem

Module:4	Communal Conflicts:	6 hours

Meaning - Causes – Consequences - Measures to prevent Communal Conflicts – Communal Harmony

Module:5	Human Trafficking:	6 hours

Meaning – Types - Causes and Consequences- Preventive Measures

Module:6	Child Abuse and Child Labour:	6 hours

Child Abuse: Meaning – Types - Effects on Children. Child Labour: Meaning – Causes. Preventive and Legislative measures

Module:7	**Violence Against Women:**	**6 hours**
Meaning - Types: Criminal violence, Domestic violence and Social violence – Causes - Consequences – Remedial measures		
Module:8	**Contemporary Issues**	**4 hours**
Guest Lecture by Industrial Experts		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Ahuja R. (2012), "**Social Problems in India",** Rawat Publications: Jaipur.
Reference Books	
1.	Madan, G. R. (2009), "Indian Social Problems", Vol.1, Allied Publishers Pvt.Ltd, New Delhi.
2.	Azad A N. (2011), "Social and Economic Problems in India", Ramesh Publishing House.
Mode of Evaluation: CAT / Assignment / Quiz / Seminar / FAT	

Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	No. 47	Date	05-10-2017

Course code	Course Title	L	T	P	J	C
HUM1041	Indian Society: Structure and Change	3	0	0	0	3

Pre-requisite	Nil	Version
		1.1

Course Objectives:

1. To provide a holistic understanding of Indian society from a sociological perspective.
2. To create awareness of Indian social institutions such as caste, family, marriage and religion.
3. To create an opportunity for students to know about the issues of socially excluded groups with reference to SCs and STs.

Course Outcomes:

Students will be able to:

1. Familiarize themselves with the different historical contexts of Indian society.
2. Understand the basic social structure of Indian society in terms of rural & urban differences
3. Clarify why family, marriage and kinship remain the most fundamental institutions in the Indian society
4. Ensure secularistic ideas and awareness among different religious communities in India
5. Discuss the patriarchal nature of Indian society and the way forward to set right attitude on gender equality through discussing contemporary issues

Student Learning Outcomes (SLO):	2, 3,11

Module:1	Approaches to the study of Indian Society	6 hours

Historical – Indological / Textual – Structural-functional – Marxian and Subaltern.

Module:2	The Structure of Indian Society	6 hours

Caste and Class System – Rural Communities - Urban Communities-Rural-urban continuum – Changing Trends.

Module:3	Family	5 hours

Meaning – Types –Traditional Family in India–Structural and functional changes in modern family.

Module:4	**Marriage**	**6 hours**
Meaning – Types –Traditional Marriage Forms – Changing Trends.		
Module:5	**Kinship**	**6 hours**
Meaning –Types – Kin marriage-Avoidance and joking relationships.		
Module:6	**Religion**	**6 hours**
Meaning-Sectarianism in Hinduism, Islam and Christianity – Role of religion in social life of Indians- Secularism in India.		
Module:7	**Gender**	**6 hours**
Women in India through Ages - Role and status of women in contemporary India - Role of women's Organizations in women empowerment.		
Module:8	**Contemporary Issues**	**4 hours**
Guest Lectures by Experts.		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Ram Ahuja, Indian Social System (Jaipur: Rawat Publication, 2013).
Reference Books	
1.	C.N. Shankar Rao, Sociology of Indian Society (New Delhi: S.Chand& Company Ltd, 2010)
2.	B.K Nagla, Indian sociological thought (Jaipur: Rawat Publication, 2013)

Mode of Evaluation: CAT, Quiz , Digital Assignments, Seminars and FAT			
Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	No. 47	Date	05-10-2017

Course Code	Course Title	L	T	P	J	C
		3	0	0	0	3
HUM1042	Industrial Relations and Labour Welfare in India					
Pre-requisite	Nil	Syllabus version				
		1.1				

Course Objectives:

1. To enable students to have an understanding of industrial organization, industrial relations and labour welfare.
2. To provide elaborate knowledge of industrial conflict and settlement mechanisms to restore industrial peace.
3. To create an awareness on various labour welfare measures initiated by different agencies besides focusing on labour education and training.

Course Outcomes:

Student will be able to:

1. Familiarize the conceptual aspects of labour force and labour union
2. Clarify the nature of industrial relations and the implications of conflicts within the organization
3. Understand the possible measures to settle the disputes caused due to organizational conflicts and the stages of labour movement in India
4. Developing comprehensive understanding on policy provisions for the welfare of the labourers
5. Emphasize the exposure in terms of education, training, etc.

Student Learning Outcomes (SLO):	2, 4, 9

Module:1	Labour Force	6 hours

Meaning – Organize labour in Factories, Plantations, Mines, Shops and Establishments – Unorganized labour in Agriculture, Construction and Quarries.

Module:2	Labour Union	6 hours

Meaning – Features – Structure- Function - Problems – Trade Union Act 1926.

Module:3	Industrial Relations	5 hours

Meaning – Key elements: Workers, Trade Union, Management and Government – Factors affecting

Industrial Relations.

Module:4	**Industrial Conflict**	**6 hours**
Meaning – Causes – Types: Strike and Lockout – Impact.		
Module:5	**Labour Movements**	**6 hours**
Labour movements in India a review of the situation		
Module:6	**Settlement of Industrial Conflict**	**6 hours**
Industrial Dispute Act 1947 - Conciliation – Arbitration – Adjudication – Collective Bargaining		
Module:7	**Labour Welfare**	**6 hours**
Meaning–Need– Agencies: Government, Employer and Worker's Organization – FactoriesAct1948- Role of Labour Welfare Officer - Labour Education and Training: Meaning – Objectives - Types of Training Programs		
Module:8	Contemporary Issues	**4 hours**
Guest Lectures by Industrial Experts.		
	Total Lecture hours:	**45 hours**

Text Book(s)

1.	Sivarethinamohan, R(2010),"Industrial Relations and Labour Welfare", PHI Learning, New Delhi

Reference Books

1.	Monappa, A (2012), "Industrial Relations and Labour Laws", Tata Mcgraw Hill, New Delhi, 2nd Edition.
2.	Dwivedi. R.S.(1997),"Human Relations and Organizational Behaviour",Macmillan India Ltd. New Delhi

Mode of Evaluation: CAT/ Quiz /Digital Assignments/Seminar/FAT

Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	No. 47	Date	05-10-2017

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Course Code	Course Title	L	T	P	J	C
HUM1043	Mass Media and Society	2	0	0	4	3
Pre-requisite	Nil	Syllabus version				
		1.1				

Course Objectives:

1. To delineate the basics of mass media particularly their types, models, theories, etc
2. To enable students to understand the role of mass media in different areas and the changes brought by them
3. To sensitize students about various social problems caused by mass media

Course Outcomes:

Students will be able to:

1. Gain insights into the basic conceptual knowledge about communication and media
2. Comprehend the impact of mass media in knowledge dissemination and social awakening
3. Cognize the contribution of mass media towards social and economic development
4. Understand the global culture and its influence through mass media
5. Develop awareness of social problems and the intervention of mass media in addressing social problems

Student Learning Outcomes (SLO):	2, 4, 15	
Module:1		**4 hours**

Communication: Meaning – Need –Types – Models -Theories of communication

Module:2		**4 hours**

Role of Mass Media: Role of Press, Radio, Cinema, and Television in knowledge dissemination and social awakening.

Module:3		**5 hours**

Impact of Mass Media on Society: Impact on Family, Marriage, Religion, Economy, Education, and Polity

Module:4		**3 hours**

Mass Media and Economic Development: Impact on Economic Development with reference to Agricultural and Industrial Development

Module:5		**4 hours**

Mass Media and Social Development: Impact on Literacy and Educational Development, Health and Family Welfare, and Women Empowerment

Module:6		**4 hours**

Mass Media and Globalization: Relationship between Mass Media and Globalization - Role of Mass Media in diffusing global culture and global consumerism in India

Module:7		**4 hours**

Mass Media and Social Problems: Violence - Sexual Harassment -Pornography – Crime - Juvenile Delinquency			
Module:8	**Interaction with Media Persons**		**2 hours**
		Total Lecture hours:	**30 hours**
Text Book(s)			
1.	Kumar, K.J. (1995). ***Mass Communications in India***, Mumbai, India: Jaico Publishing House.		
Reference Books			
1.	Vil'anilam, J.V. (2004). ***Communication and Mass Communication in India***, Delhi: India: B.R. Publishing Corporation.		
2.	DeFleur, M.L. and Dennis, E.E. (1991), ***Understanding Mass Communication***, New Delhi: India: Goyal Saab.		
	Sample Projects:		**15 hours**
1.	Research projects on role of mass media in knowledge dissemination and social awakening		
2.	Research Projects on impact of mass media on family life.		
3.	Research Projects on role of mass media in socio-economic development		
4.	Case studies on media and social problems in India.		
5.	Short films on relationship between mass media and globalization.		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	26-05-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

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BRIDGE COURSES

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Course code	INTRODUCTION TO LIFE SCIENCES	L	T	P	J	C
BIT 1001		4	0	0	0	4
Pre-requisite	NIL	Syllabus version				
		2.10				

Course Objectives:

1. Compare living beings and lives processes.
2. Illustrate biota, biosphere, biodiversity and biological evolution.
3. Create interests in life sciences.

Expected Course Outcome:

1. Understand the science of life.
2. Determine the adaptations of biota and their functions in the nature.
3. Develop ideas, facts and theories relevant to biodiversity.
4. Choose new sources of renewable energy.
5. Analyze the contemporary issues of nature and role of biospheres.
6. Construct advanced biotechnologies for the sustainable utilizations and conservation.

Student Learning Outcomes (SLO):	2, 9, 11

Module:1	DIVERSITY IN THE LIVING WORLD	10 hours

Origin of life, Characteristics of Life, Linnaean and Whittaker' classification, Plant Kingdom-Classification, Structure, types and modifications of root, stem and leaf. Animal Kingdom-Classification and taxonomical aids.

Module:2	CELL STRUCTURE AND FUNCTIONS	8 hours

Structures of prokaryotic and Eukaryotic cells, levels of organization, cellular organelles and functions, nuclear components. Major cell types, concepts of cell theory, Cell Cycle and Cell Division.

Module:3	CHEMISTRY OF LIFE	8 hours

Bio-macromolecules, central Dogma of Molecular Biology, nucleic acids, proteins, carbohydrates, lipids , fats, Vitamins and Minerals; cellular metabolism.

Module:4	MICROORGANISMS, ECOLOGYAND EVOLUTION	12hours

Microbial World, Classification. structure and types of bacteria, virus, micro algae and fungi, Microbial Growth, beneficial and harmful microorganisms. Ecology, Niches, Food chain and Food Web, Migration; Pollution. Theories of Evolution. Lamarckism, Darwinism, Speciation.

Module:5	PLANT PHYSIOLOGY	8 hours

Plant cell growth and differentiation, germination, photosynthesis, respiration, transpiration, transport of food, nutrients and water, Phyto-hormones, concept of totipotency.

Module:6	**ANIMAL/HUMAN PHYSIOLOGY**	**8 hours**
Circulatory System, Excretory System, Immune system, Nervous system, Digestive system. Sensory organs.		
Module:7	**GENETICS**	**8 hours**
Mendelian Genetics, Laws of Inheritance, Mono, di hybrid crosses, polygenic inheritance, Multiple alleles, Linkage and Crossing Over, Eugenics		
Module:8	**BIOTECHNOLOGY**	**6 hours**
History of important discoveries in biotechnology.rDNA technology, Gene cloning and applications- Dolly, Polly, ANDi, Bt Cotton, Applications in Health care and Agriculture; Ethical Issues.		
Total Lecture hours:	**60 hours**	

Text Book(s)	
1.	Campbell,N.A. Reece,J.B., and Simon, E.J. 2015. Essential Biology with Physiology (6th Edition). Campbell Biology Websites Series.

Recommended by Board of Studies	03-08-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

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Course Code	Course Title	L	T	P	J	C
MAT-1001	Fundamentals of Mathematics	3	2	0	0	4
Pre-requisite	None	Syllabus Version				
		1.0				

Course Objectives:

1. This fundamental course on Basic Mathematics provides requisite and relevant background necessary to understand the other important engineering mathematics courses. Further this course is a prerequisite for the non- mathematics students to learn further topics of Engineering Mathematics.

Expected Course Outcome

At the end of this course the students are expected to

1. Solve a system of equations by matrix method and trigonometry
2. Know the concept of differentiation, integration and evaluation of area and volume by integration techniques.
3. Explain the concept of ordinary differential equations and have learnt the methods of solving second order differential equations with constant coefficients.
4. Understand the concept of analytic geometry and vector algebra.
5. Use the mathematical logic and basic probability for higher studies.

Student Learning Outcomes (SLO):	1,2,9

Module:1	Matrices	5 hours

Matrices - types of matrices - operations on matrices-determinants - adjoint matrix -inverse of a matrix -solution of a system of linear equations by inversion method–elementary transformations – rank of a matrix - consistency and inconsistency of system of equations

Module:2	Differential Calculus	6 hours

Differentiation of functions of single variable – differentiation techniques physical interpretations - differentiation of implicit function – higher order derivatives – Taylor's series - maxima and minima for functions of a single variable

Module:3	Integral Calculus	6 hours

Partial fractions - Integration- integration techniques- integration by parts definite integrals – properties- evaluation of area and volume by integration

Module:4	Linear Ordinary Differential Equations	6 hours

Differential equations-definition and examples- formation of differential equation- solving differential equations of first order-solving second order homogenous differential equations with

constant coefficients.			
Module:5	**Analytic geometry**	**5 hours**	
Analytic geometry of three dimensions-direction cosines and direction ratios-plane, straight line and sphere			
Module:6	**Vector Algebra**	**7 hours**	
Vectors–operations on vectors-angle between two vectors-projection of one vector on another vector–equations of plane, straight line and sphere in vector forms-shortest distance between two skew lines- equation of a tangent plane to a sphere.			
Module:7	**Logic and Probability**	**8 hours**	
Mathematical logic – propositions – truth table – connectives– tautology – contradiction. Permutations and combinations – probability – classical approach – addition law- conditional probability -multiplicative law- Baye's theorem and applications.			
Module:8	**Contemporary Issues**	**2 hours**	
Industry Expert Lecture			
	Total Lecture hours:	**45 hours**	
Tutorial	• A minimum of 10 problems to be worked out by students in every Tutorial Class. • Another 5 problems per Tutorial Class to be given as home work. Mode: Individual Exercises, Team Exercises, Online Quizzes, Online Discussion Forums	**30 hours**	
Text Book(s)			
	1. K. A. Stroud and Dexter J. Booth, Engineering Mathematics, 7th Edition, Palgrave Macmillan (2013).		
Reference Books			
	1. B. S. Grewal, Elementary Engineering Mathematics, 43rd edition, Khanna Publications, (2015). 2. Seymour Lipschutz and Marc Lipson, Discrete Mathematics, 3rd Edition, Tata McGraw - Hill (2010). 3. Seymour Lipschutz and John Schiller, Introduction to Probability and Statistics, 2nd Edition, Tata McGraw -Hill (2011).		
Mode of Evaluation			
Digital Assignments(Solutions by using soft skill), Quiz, Continuous Assessments, Final Assessment Test			
Recommended by Board of Studies	16-08-2017		
Approved by Academic Council	No. 47	Date	05-10-2017

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Course code	Course title	L	T	P	J	C
ENG1002	Effective English	0	0	4	0	2
Pre-requisite	Not cleared English Proficiency Test (EPT)	Syllabus version				
		v.2.0				

Course Objectives:

1. To enable students develop basic proficiency in Language Skills
2. To help students overcome communication barriers
3. To facilitate students communicate effectively in academic and social contexts

Expected Course Outcome:

1. Speak fluently in academic and social contexts
2. Listen for global and specific comprehension to improve study skills like note taking, summarizing, etc
3. Read and comprehend technical and general texts
4.Write grammatically correct creative and descriptive sentences and paragraphs in specific contexts
5. Enact on social contexts with a message, and communicate clearly and effectively in formal and informal contexts

Student Learning Outcomes (SLO): **16, 18**

Module:1	Speaking	**4hours**
Introduce yourself using Temperament Sorter		
Module:2	Listening	**4 hours**
Listen to songs – Gap-fill Exercise		
Module:3	Reading	**2 hours**
Loud Reading with focus on pronunciation		
Module:4	Writing	**2 hours**
Make sentences using jumbled words		
Module:5	Listening	**4 hours**
Listen to Motivational Speeches – Note taking		
Module:6	Speaking	**4 hours**
Situational Dialogues		
Module:7	Reading	**2hours**
Reading for vocabulary development		

Module:8	Writing	**2hours**
Descriptive Writing – Process		
Compare & Contrast – Product description		
Module:9	Listening	**4hours**
Minimal Pairs- Difficult Sounds for Indian Speakers		
Module:10	Speaking	**4hours**
Just a Minute		
Module:11	Reading	**2hours**
Global Comprehension		
Module:12	Writing	**2hours**
Travelogue Writing - 25+ FAQs (Wh-questions) on a place they have visited – Pair work		
Module:13	Listening	**4hours**
Listen to a Documentary/Talk show and summarize		
Module:14	Speaking	**4 hours**
Discuss facts and opinions using question tags		
Module:15	Speaking**:**	**4hours**
Role Play with a Message		
Module:16	Writing	**2hours**
Formal Letter Writing focusing on Content		
Module:17	Vocabulary	**2hours**
Correct spelling errors		
Module:18	Speaking	**4 hours**
Asking for and giving Directions/Instructions		
Module:19	Reading	**2hours**
Factual Comprehension		
Module:20	Writing	**2 hours**
Story writing using prompts/pictures		

	Total Practical hours:	**60hours**

Text Books

1.	Lewis Lansford and Peter Astley. Oxford English for Careers: Engineering 1: Student's Book. 2013. USA: Oxford University Press.
2.	Jaimie Scanlon. Q: Skills for Success 1 Listening & Speaking. 2015. [Second Revised Edition]. Oxford: Oxford University Press.

Reference Books

1.	Sanjay Kumar and Puspalata. Communication Skills. 2015. [Second Edition] Print. New Delhi: Oxford University Press.
2.	John Seely. Oxford Guide to Effective Writing and Speaking. 2013. [Third Edition].New Delhi: Oxford University Press.
3.	Meenakshi Raman. Communication Skills. 2011. [Second Edition]. New Delhi: Oxford University Press.
4.	Terry O'Brien. Effective Speaking Skills. 2011. New Delhi: Rupa Publishers.
5.	BarunMitra. Effective Technical Communication: AGuide for Scientists and Engineers. 2015. New Delhi: Oxford University Press.

Mode of Evaluation: Online Quizzes, Presentation, Role play, Group Discussions, Assignments, Mini project.

List of Challenging Experiments (Indicative)		**CO:1,2,3,4,5**
1.	Speaking: Introduce yourself using Temperament Sorter	8 hours
2.	Reading: Loud Reading with focus on pronunciation	4 hours
3.	Writing: Descriptive Writing – Process Compare & Contrast – Product description	6 hours
4.	Speaking: Just a Minute / Activities through VIT Community Radio	6 hours
5.	Writing: Travelogue Writing - 25+ FAQs (Wh-questions) on a place they have visited – Pair work	10 hours
6.	Speaking: Discuss facts and opinions using question tags	6 hours
7.	Writing: Formal Letter Writing focusing on Content	6 hours
8.	Vocabulary: Correct spelling errors	4 hours
9.	Speaking: Asking for and giving Directions/Instructions	6 hours
10.	Writing: Story writing using prompts/pictures	4 hours
	Total Laboratory Hours	60 hours

Mode of evaluation: Online Quizzes, Presentation, Role play, Group Discussions, Assignments, Mini project.

Recommended by Board of Studies	22-07-2017		
Approved by Academic Council	No. 46	Date	24-08-2017