VIT®

Vellore Institute of Technology

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

SCHOOL OF CIVIL ENGINEERING

B. Tech. Civil Engineering

(B. Tech. BCL)

Curriculum

(*2018-2019 admitted students*)

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 CIVIL ENGINEERING

- To be internationally recognized in Civil Engineering through groundbreaking contributions and exceptional leadership for sustainable development of the society.

MISSION STATEMENT OF THE SCHOOL OF CIVIL ENGINEERING

- To Pioneer the emerging technology in Civil Engineering.
- To address the complex societal scale challenges in areas of resilient infrastructure, smart and sustainable cities, water and energy security, climate change, mobility of goods and people, and environmental protection.
- To inspire and nurture innovative leaders and entrepreneurs.

B. Tech. Civil Engineering

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.

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

B. Tech. Civil Engineering

PROGRAMME SPECIFIC OUTCOMES (PSOs)

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

PSO_01: Develop and apply innovative, state-of-the-art practices and technologies and Provide sustainable solutions to the Civil Engineering Problems

PSO_02: Plan, design, construct and operate society economic and social engine that built the environment and also protecting, restoring the natural environment

PSO_03: Apply modern techniques, advanced materials, equipment and management tools so as to complete the civil engineering project within specified time and funds.

B. Tech. Civil Engineering

CREDIT STRUCTURE

Category-wise Credit distribution

Category	Credits
University core (UC)	70
Programme core (PC)	61
Programme elective (PE)	37
University elective (UE)	12
Bridge course (BC)	-
Total credits	**180**

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B. Tech. Civil Engineering

DETAILED CURRICULUM

University Core

S. No.	Course Code	Course Title	L	T	P	J	C
1.	CHY1002	Environmental Sciences	3	0	0	0	3
2.	CHY1701	Engineering Chemistry	3	0	2	0	4
3.	CSE1001	Problem Solving and Programming	0	0	6	0	3
4.	CSE1002	Problem Solving and Object Oriented Programming	0	0	6	0	3
5.	CLE3099	Industrial Internship	0	0	0	0	2
6.	CLE3999	Technical Answers for Real World Problems (TARP)	1	0	0	8	3
7.	CLE4098	Comprehensive Examination	0	0	0	0	2
8.	CLE4099	Capstone Project	0	0	0	0	20
9.	ENG1011	English for Engineers	0	0	4	0	2
10.	HUM1021	Ethics and Values	2	0	0	0	2
11.	MAT1011	Calculus for Engineers	3	0	2	0	4
12.	MAT2001	Statistics for Engineers	2	1	2	0	4
13.	MGT1022	Lean Start-up Management	1	0	0	4	2
14.	PHY1701	Engineering Physics	3	0	2	0	4
15.	PHY1999	Introduction to Innovative Projects	1	0	0	4	2
16.	FLC4097	Foreign Language	2	0	0	0	2
17.	EXC4097	Extra / Curricular Activity Basket	0	0	0	0	2
18.	STS4097	Soft Skills	0	0	0	0	6

B. Tech. Civil Engineering

Programme Core

S. No.	Course Code	Course Title	L	T	P	J	C
1.	CLE1003	Surveying	3	0	2	4	5
2.	CLE1004	Soil Mechanics and Foundation Engineering	3	0	2	0	4
3.	CLE1006	Environmental Engineering	2	0	2	4	4
4.	CLE1007	Construction Materials and Techniques	3	0	0	0	3
5.	CLE2001	Building Drawing	1	0	2	4	3
6.	CLE2002	Strength of Materials	2	2	2	0	4
7.	CLE2003	Structural Analysis	2	2	0	0	3
8.	CLE2004	Water Resource Engineering	2	0	2	4	4
9.	CLE2005	Transportation Engineering	2	0	0	4	3
10.	CLE3001	Quantity Surveying and Estimating	2	0	0	0	2
11.	CLE3002	Basics of Structural Design	2	2	2	0	4
12.	MAT2002	Applications of Differential and Difference Equations	3	0	2	0	4
13.	MAT3003	Complex variables and Partial Differential Equations	3	2	0	0	4
14.	MAT3005	Applied Numerical Methods	3	2	0	0	4
15.	MEE1001	Engineering Drawing	1	0	4	0	3
16.	MEE1002	Engineering Mechanics	2	2	0	0	3
17.	MEE1004	Fluid Mechanics	2	2	2	0	4

B. Tech. Civil Engineering

Programme Elective

Sl. No.	Course Code	Course Title	L	T	P	J	C
1.	CLE1010	Natural Disaster Mitigation and Management	3	0	0	0	3
2.	CLE1011	Engineering Geology	2	0	0	4	3
3.	CLE1013	Environmental Impact Assessment	3	0	0	0	3
4.	CLE1016	Urban Planning	3	0	0	0	3
5.	CLE2007	Advanced Concrete Technology	3	0	2	4	5
6.	CLE2008	Construction Planning and Management	3	0	0	0	3
7.	CLE2009	Advanced Soil Mechanics	2	2	0	0	3
8.	CLE2010	Ground Improvement Techniques	2	0	0	4	3
9.	CLE2011	Soil Dynamics and Machine Foundation	2	2	0	0	3
10.	CLE2013	Advanced Foundation Engineering	2	2	0	0	3
11.	CLE2014	Geotechnical Earthquake Engineering	2	0	0	4	3
12.	CLE2015	Hydraulic Structures and Machinery	2	2	2	0	4
13.	CLE2017	Hydrology	3	0	0	0	3
14.	CLE2018	Industrial Wastes Treatment and Disposal	2	0	0	4	3
15.	CLE2019	Pollution Control and Monitoring	2	0	0	4	3
16.	CLE2020	Solid Waste Management	2	0	0	4	3
17.	CLE2022	Economics and Business Finance for Civil Engineers	3	0	0	0	3
18.	CLE2023	GIS and Remote Sensing	2	0	2	0	3
19.	CLE3004	Advanced Structural Analysis	2	2	2	0	4
20.	CLE3005	Ground Water Engineering	3	0	0	0	3
21.	CLE3007	Traffic Engineering	2	0	0	4	3
22.	CLE3008	Transport Planning and Management	2	0	0	4	3
23.	CLE3010	Architecture and Town Planning	2	0	0	4	3
24.	CLE3011	Finite Element Methods	2	2	0	0	3

Sl. No.	Course Code	Course Title	L	T	P	J	C
25.	CLE4001	Design of Steel Structures	3	0	2	0	4
26.	CLE4002	Design of Advanced Concrete Structures	2	0	0	4	3
27.	CLE4003	Prestressed Concrete Design	3	0	0	0	3
28.	CLE4004	Seismic Design of Structures	2	2	0	0	3
29.	MEE1024	Operations Research	2	2	0	0	3

University Elective Baskets

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

Sl. No.	Code	Title	L	T	P	J	C
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

Sl. No.	Code	Title	L	T	P	J	C
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

Sl. No.	Code	Title	L	T	P	J	C
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

CHY1002	Environmental Sciences	L	T	P	J	C
		3	0	0	0	3
Pre-requisite		Syllabus version				
		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.

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, 4th Edition, 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

CHY1701	Engineering Chemistry	L	T	P	J	C
		3	0	2	0	4
Pre-requisite		Syllabus version				
		1.0				

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

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. 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

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	3 h

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	6 h
4.	Material Analysis: Quantitative colorimetric determination of divalent metal ions of Ni/Fe/Cu using conventional and smart phone digital-imaging methods	8 h
5.	Analysis of Iron in carbon steel by potentiometry	3 h
6.	Construction and working of an Zn-Cu electrochemical cell	4 h
7.	Determination of viscosity-average molecular weight of different natural / synthetic polymers	3 h
8.	Arduino microcontroller based sensor for monitoring pH / temperature/ conductivity in samples.	3 h
Total Laboratory Hours		**30 hours**

Mode of Evaluation: Viva-voce and Lab performance & FAT			
Recommended by Board of Studies	31-05-2019		
Approved by Academic Council	50th ACM	**Date**	13-06-2019

CSE1001	PROBLEM SOLVING AND PROGRAMMING	L	T	P	J	C
		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

List of Challenging Experiments (Indicative)

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool	4 Hours
2. Introduction to Python, Demo on IDE, Keywords, Identifiers, I/O Statements.	4 Hours
3. Simple Program to display Hello world in Python.	
4. Operators and Expressions in Python	4 Hours
5. Algorithmic Approach 1: Sequential	4 Hours
6. Algorithmic Approach 2: Selection (if, if.. else, nested if else	4 Hours
7. Algorithmic Approach 3: Iteration (while and for)	6 Hours
8. Strings and its Operations	6 Hours
9. Regular Expressions	6 Hours
10. List and its operations.	6 Hours
11. Dictionaries: operations	6 Hours
12. Tuples and its operations	6 Hours
13. Set and its operations	6 Hours
14. Functions, Recursions	6 Hours
15. Sorting Techniques (Bubble / Selection / Insertion)	6 Hours
16. Searching Techniques : Sequential Search and Binary Search	3 Hours
17. Files and its Operations	4 Hours
Total Lecture hours	**90 hours**

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.

<table>
<tr><td colspan="4">2. Charles Dierbach.2013.Introduction to computer science using python: a computational problem-solving focus. Wiley Publishers.</td></tr>
<tr><td colspan="4">Mode of Evaluation: PAT / CAT / FAT</td></tr>
<tr><td>Recommended by Board of Studies</td><td colspan="3">04.04.2014</td></tr>
<tr><td>Approved by Academic Council</td><td>38th ACM</td><td>Date</td><td>23.10.2015</td></tr>
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CSE1002	Problem Solving and Object Oriented Programming	L	T	P	J	C
		0	0	6	0	3
Pre-requisite	NIL	Syllabus version				
		1.0				

Course Objectives:

1. To emphasize the benefits of object oriented concepts
2. To enable the students to solve the real time applications using object oriented programming features.
3. To improve the skills of a logical thinking and to solve the problems using any processing elements

Expected Course Outcome:

1. Recall 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. Propose 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

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 overloading – 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 Fi les	10 hours
IOstreams and Files IOstreams, Manipulators- overloading Inserters (<<) and Extractors (>>) Sequential and Random files – writing and reading objects into / from files		
	Total Lab 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 HallInc., 1988.

Reference Books

1. Bjarnestroustrup, 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**	**10 hours**
	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.	
2.	**Budget Allocation for Marketing Campaign**	**15 hours**
	A mobile manufacturing company has got several marketing options such as Radio advertisement campaign, TV non peak hours campaign, City top paper network, Viral marketing campaign, Web advertising. From their previous experience, they have got a statistics about pay backs for each marketing option. Given the marketing budget (rupees in crores) for the current year and details of 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**	**10 hours**
	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.	**Register Allocation Problem**	**15 hours**
	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.	

5.	**Selective Job Scheduling Problem** **15 hours** 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 andimplement 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 inascending order.	
6.	**Fragment Assembly in DNA Sequencing** **15 hours** 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 superstringis 0001110100. Given a set of reads, implement an algorithm to find the shortest superstring that contains all the given reads.	
7.	**House Wiring** **10 hours** 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.	
Total Laboratory Hours		**90 hours**

Recommended by Board of Studies	29.10.2015		
Approved by Academic Council	39th ACM	**Date**	17.12.2015

CLE3099	INDUSTRY INTERNSHIP	L	T	P	J	C
		0	0	0	0	2
Pre-requisite	Completion of minimum of Two semesters	**Syllabus version**				
		1.0				

Course Objectives:

1. 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

Contents	**4 Weeks**
Four weeks of work at industry site. Supervised by an expert at the industry.	

Mode of assessment: Internship Report, Presentation and Project Review

Recommended by Board of Studies	28.02.2016		
Approved by Academic Council	37th ACM	**Date**	16.06.2016

CLE3999	TECHNICAL ANSWERS FOR REAL WORLD PROBLEMS (TARP)	L	T	P	J	C
		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 for analysing 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

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 / modelling / 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 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	37th ACM	**Date**	16.06.2016

CLE4098	COMPREHENSIVE EXAMINATION	L	T	P	J	C
		0	0	0	0	2
Pre-requisite	NIL	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 for analysing 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

Module: 1	Structural Engineering	15 hours

Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Friction and its applications; Kinematics of point mass and rigid body; Centre of mass; Euler's equations of motion; Impulse-momentum; Energy methods; Principles of virtual work.

Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Theories of failures; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, buckling of column, combined and direct bending stresses.
Structural Analysis: Statically determinate and indeterminate structures by energy methods; Analysis of trusses, arches, beams, and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.

Steel Structures: Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Plastic analysis of beams and frames.
Concrete Structures: Working stress, Limit state and Ultimate load design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete; Analysis of beam sections at transfer and service loads.

Construction Materials and Management: Construction Materials: Structural steel - composition, material properties and behaviour; Concrete - constituents, mix design, short-term and long-term properties; Bricks and mortar; Timber. Construction Management: Types of construction projects; Tendering and construction contracts; Rate analysis and standard specifications; Cost estimation; Project planning and network analysis - PERT and CPM

Module: 2	Geotechnical Engineering	

Soil Mechanics: Origin of soils, soil structure and fabric; Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability -

one dimensional flow, Darcy's law; Seepage through soils - two-dimensional flow, flow nets; Principle of effective stress, capillarity, seepage force and quicksand condition; Compaction in laboratory and field conditions; One dimensional consolidation, time rate of consolidation; Mohr's circle, effective and total shear strength parameters, characteristics of clays and sand.

Foundation Engineering: Sub-surface investigations - scope, drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Rankine's Earth pressure theory; Stability of slopes - finite and infinite slopes, method of slices and Bishop's method; Stress distribution in soils - Boussinesq's and Westergaard's theories, pressure bulbs; Shallow foundations - Terzaghi's bearing capacity theory, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - types of piles, dynamic and static formulae, load capacity of piles in sands and clays, pile load test, negative skin friction.

Module: 3	**Water Resources Engineering**	

Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum, energy and corresponding equations; Potential flow, applications of momentum and energy equations; Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth.

Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Kinematics of flow, velocity triangles; Basics of hydraulic machines, specific speed of pumps and turbines; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, slope profile, hydraulic jump, uniform flow and gradually varied flow

Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, flood estimation and routing, reservoir capacity, reservoir and channel routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's law; Geophysical investigation.

Irrigation: Duty, delta, estimation of evapo-transpiration; Crop water requirements; Design of lined and unlined canals, head works, gravity dams and spillways; Design of weirs on permeable foundation; Types of irrigation systems, irrigation methods; Water logging and drainage; Canal regulatory works, cross-drainage structures, outlets and escapes.

Module: 4	**Environmental Engineering**	

Water: Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water.

Waste Water: Sewage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, effluent discharge standards. Domestic wastewater treatment, quantity of characteristics of domestic wastewater, primary and secondary treatment. Unit operations and unit processes of domestic wastewater, sludge disposal.

Module: 5	**Transportation and Geomatics Engineering**	

Transportation Infrastructure: Highway alignment and engineering surveys; Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments.

Highway Pavements: Highway construction; Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible pavement using IRC: 37-2012; Design of rigid pavements using IRC: 58-2011; Failures in flexible and rigid pavements.

Traffic Engineering: Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Control devices; Types of intersections and channelization. **Surveying:** Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Leveling and trigonometric leveling; Traversing and triangulation survey; Total station; Horizontal and vertical curves; Basics of Geographical information system (GIS) and Geographical Positioning system (GPS).			
Mode of Evaluation: (No FAT) Continuous Assessment 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	37th ACM	**Date**	16.06.2016

CLE4099	CAPSTONE PROJECT	L	T	P	J	C
		0	0	0	0	20
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

Topics

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	37th ACM	**Date**	16.06.2015

ENG1011	ENGLISH FOR ENGINEERS	L	T	P	J	C
		0	0	4	0	2
Pre-requisite	Cleared English Proficiency Test (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.

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, United Kingdom

Reference Books

1. Steven Brown, Dorolyn Smith, Active Listening 3, 2011, 3rd Edition, Cambridge University Press, UK
2. Tony Lynch, Study Listening, 2013, 2nd Edition, Cambridge University Press, UK
3. Liz Hamp-Lyons, Ben Heasley, Study Writing, 2010, 2nd Edition, Cambridge University Press, UK
4. Kenneth Anderson, Joan Maclean, Tony Lynch, Study Speaking, 2013, 2nd Edition, Cambridge

University Press, UK
5. Eric H. Glendinning, Beverly Holmstrom, Study Reading, 2012, 2nd Edition Cambridge University Press, UK
6. Michael Swan, Practical English Usage (Practical English Usage), Jun 2017, 4th edition, Oxford University Press, UK
7. Michael McCarthy, Felicity O'Dell, English Vocabulary in Use Advanced (South Asian Edition), May 2015, Cambridge University Press, UK
8. Michael Swan, Catherine Walter, Oxford English Grammar Course Advanced, Feb 2012, 4th Edition, Oxford University Press, UK
9. Heather Silyn-Roberts, Writing for Science and Engineering: Papers, Presentations and Reports, Jun 2016, 2nd Edition, Butterworth-Heinemann, UK

Mode of Evaluation: Mini Project, Flipped Class Room, Lecture, PPT's, Role play, Assignments Class / Virtual Presentations, Report and beyond the classroom activities

List of Challenging Experiments (Indicative)		
1.	Create a Digital or Online Profile or a Digital Footprint	6 hours
2.	Prepare a video resume	8 hours
3.	Analyse a documentary critically	4 hours
4.	Turn Coat- Speaking for and against the topic / Activities through VIT Community Radio	6 hours
5.	Present a topic using 'Prezi'	6 hours
6.	Analyse a case on cross cultural communication critically	6 hours
7.	Create a list of words relating to your domain	4 hours
8.	Listen to a conversation of native speakers of English and answer the following questions	6 hours
9.	Read an article and critically analyse the text in about 150 words	6 hours
10.	Read an autobiography and role play the character in class by taking an excerpt from the book	8 hours
11.	Create a Digital or Online Profile or a Digital Footprint	6 hours
Total Laboratory Hours		**60 hours**

Mode of assessment: Mini Project, Flipped Class Room, Lecture, PPT's, Role play, Assignments Class / Virtual Presentations, Report and beyond the classroom activities

Recommended by Board of Studies	22.07.2017		
Approved by Academic Council	47th ACM	**Date**	24.08.2017

HUM1021	ETHICS AND VALUES	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	Nil	Syllabus version				
		1.2				

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

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**	**3 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**	**4 hours**
Abuse of different types of legal and illegal drugs: ethical values, causes, impact, laws and prevention		
Module: 6	**Personal and Professional Ethics**	**3 hours**
Dishonesty - Stealing - Malpractices in Examinations – Plagiarism		
Module: 7	**Abuse of technologies**	**4 hours**
Hacking and other cyber crimes, addiction to mobile phone usage, video games and social networking websites		
Module: 8	**Invited Talk:** Contemporary Issues	**3 hours**
Total Lecture hours		**30 hours**

Reference Books			
1. Dhaliwal, K.K (2016), "Gandhian Philosophy of Ethics: A Study of Relationship between his Presupposition and Precepts, Writers Choice, New Delhi, India 2. Vittal, N (2012), "Ending Corruption? - How to Clean up India?", Penguin Publishers, UK 3. Pagliaro, L.A. and Pagliaro, A.M (2012), "Handbook of Child and Adolescent Drug and Substance Abuse: Pharmacological , Developmental and Clinical Considerations", Wiley Publishers, U.S.A 4. Pandey, P. K (2012), "Sexual Harassment and Law in India", Lambert Publishers, Germany			
Mode of Evaluation: CAT, Assignment, Quiz, FAT and Seminar			
Recommended by Board of Studies	26.07.2017		
Approved by Academic Council	46th ACM	**Date**	24.08.2017

MAT1011	CALCULUS FOR ENGINEERS	L	T	P	J	C
		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 etc.
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 should be able to

1. Apply single variable differentiation and integration to solve applied problems in engineering and find the maxima and minima of functions
2. Understand basic concepts of Laplace Transforms and solve problems with periodic functions, step functions, impulse functions and convolution
3. Evaluate partial derivatives, limits, total differentials, Jacobians, Taylor series and optimization problems involving several variables with or without constraints
4. Evaluate multiple integrals in Cartesian, Polar, Cylindrical and Spherical coordinates.
5. Understand gradient, directional derivatives, divergence, curl and Greens', Stokes, Gauss theorems
6. Demonstrate MATLAB code for challenging problems in engineering

Module: 1	Application of Single Variable Calculus	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 its properties.

Module: 4	Application of Multivariable Calculus	5 hours

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

Reference Books

1. Higher Engineering Mathematics, B.S. Grewal, 43rd Edition, Khanna Publishers, 2015
2. Higher Engineering Mathematics, John Bird, 6th Edition, Elsevier Limited, 2017
3. Calculus: Early Transcendentals, James Stewart, 8th edition, Cengage Learning, 2017
4. Engineering Mathematics, K. A. Stroud and Dexter J. Booth, 7th Edition, Palgrave Macmillan (2013)

Mode of Evaluation: Digital Assignments, Quiz, Continuous Assessments, Final Assessment Test

List of Challenging Experiments (Indicative)

1.	Introduction to MATLAB through matrices, and general Syntax	3 hours
2.	Plotting and visualizing curves and surfaces in MATLAB – Symbolic computations using MATLAB	3 hours
3.	Evaluating Extremum of a single variable function	3 hours
4.	Understanding integration as Area under the curve	3 hours
5.	Evaluation of Volume by Integrals (Solids of Revolution)	3 hours
6.	Evaluating maxima and minima of functions of several variables	3 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 Green's theorem to real world problems	2 hours
Total Laboratory Hours		**30 hours**

Mode of Assessment: Weekly Assessment, Final Assessment Test

Recommended by Board of Studies	12.06.2015		
Approved by Academic Council	37th ACM	**Date**	16.06.2015

MAT2001	STATISTICS FOR ENGINEERS	L	T	P	J	C
		3	0	2	0	4
Prerequisites	MAT1011 – Calculus for Engineers	Syllabus Version: 1.1				

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 relationship of real-time data.
3. To apply estimation and testing methods to make inference and modelling techniques for decision making.

Expected Course Outcome:

At the end of the course the student should be able to:

1. Compute and interpret descriptive statistics using numerical and graphical techniques.
2. Understand the basic concepts of random variables and find an appropriate distribution for analysing data specific to an experiment.
3. Apply statistical methods like correlation, regression analysis in analysing, interpreting experimental data.
4. Make appropriate decisions using statistical inference that is the central to experimental research.
5. Use statistical methodology and tools in reliability engineering problems.
6. Demonstrate R programming for statistical data

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 – Rank Correlation– Partial and Multiple correlation– Multiple regression.

Module: 4	Probability Distributions	7 hours

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)

1. Probability and Statistics for engineers and scientists, R. E. Walpole, R. H. Myers, S. L. Mayers and K. Ye, 9th Edition, Pearson Education (2012).
2. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 6th Edition, John Wiley & Sons (2016).

Reference books

1. Reliability Engineering, E. Balagurusamy, Tata McGraw Hill, Tenth reprint 2017.
2. Probability and Statistics, J. L. Devore, 8th Edition, Brooks / Cole, Cengage Learning (2012).
3. Probability and Statistics for Engineers, R. A. Johnson, Miller Freund's, 8th edition, Prentice Hall India (2011).
4. Probability, Statistics and Reliability for Engineers and Scientists, Bilal M. Ayyub and Richard H. McCuen, 3rd edition, CRC press (2011).

Mode of Evaluation: Digital Assignments, Continuous Assessment Tests, Quiz, Final Assessment Test.

List of Experiments (Indicative)

1.	Introduction: Understanding Data types; importing / exporting data.	3 hours
2.	Computing Summary Statistics / plotting and visualizing data using Tabulation and Graphical Representations.	3 hours
3.	Applying correlation and simple linear regression model to real dataset; computing and interpreting the coefficient of determination.	3 hours
4.	Applying multiple linear regression model to real dataset; computing and interpreting the multiple coefficient of determination.	3 hours
5.	Fitting the following probability distributions: Binomial distribution	3 hours
6.	Normal distribution, Poisson distribution	3 hours
7.	Testing of hypothesis for One sample mean and proportion from real-time problems.	3 hours
8.	Testing of hypothesis for Two sample means and proportion from real-time problems	3 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 real dataset	2 hours
11.	Performing ANOVA for real dataset for Completely randomized design, Randomized Block design, Latin square Design	2 hours
Total laboratory hours		**30 hours**

Mode of Evaluation: Weekly Assessment, Final Assessment Test

Recommended by Board of Studies	25.02.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

MGT1022	LEAN START-UP MANAGEMENT	L	T	P	J	C
		1	0	0	4	2
Pre-requisite	**Nil**	**Syllabus version**				
		v. 2.2				

Course Objectives:

The objective of the course is to make a student to create and commercialize the product

Course Outcome:

Upon successful completion of the course the students will be able to

1. Understand developing business models and growth drivers
2. Use the business model canvas to map out key components of enterprise
3. Analyze market size, cost structure, revenue streams, and value chain
4. Understand build-measure-learn principles
5. Foreseeing and quantifying business and financial risks

Module: 1		**2 hours**
Creativity and Design Thinking (identify the vertical for business opportunity, understand your customers, accurately assess market opportunity)		
Module: 2		**3 hours**
Minimum Viable Product (Value Proposition, Customer Segments, Build-measure-learn process)		
Module: 3		**3 hours**
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)		
Module: 4		**3 hours**
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)		
Module: 5		**2 hours**
Legal, Regulatory, CSR, Standards, Taxes		
Module: 6	**Contemporary discussion**	**2 hours**
	Total Lecture hours	**15 hours**

Text Book(s)

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

Reference Books

1. Steve Blank (2014) Holding a Cat by the Tail, K&S Ranch Publishing LLC
2. Karal T Ulrich, Product Design and Development, SDEppinger, McGraw Hill
3. Peter Thiel, (2014) Zero to One: Notes on Startups, or How to Build the Future, Crown Business;
4. Lean Analytics: Use Data to Build a Better Startup Faster (Lean Series), Alistair Croll &

Benjamin Yoskovitz, O'Reilly Media; 1st Edition
5. Marty Cagan, (2008) Inspired: How To Create Products Customers Love, SVPG Press; 1st edition

J Component			**60 hours**
Recommended by Board of Studies	17-08-2017		
Approved by Academic Council	47	**Date**	05-10-2017

PHY1701	ENGINEERING PHYSICS	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	Physics of 12th standard or equivalent	Syllabus version				
		1.0				

Course Objectives:

To enable the students to understand the basics of the latest advancements in Physics viz., Quantum Mechanics, Nanotechnology, Lasers, Electro Magnetic Theory and Fiber Optics.

Expected Course Outcome:

On completion of this course the students will be able to:

1. To understand the dual nature of radiation and matter.
2. To apply Schrodinger's equations to solve finite and infinite potential problems.
3. To apply quantum ideas at the nanoscale.
4. To apply quantum ideas for understanding the operation and working principle of optoelectronic devices.
5. To analyze the Maxwell's equations in differential and integral form.
6. To classify the optical fiber for different Engineering applications.
7. To apply concept of Lorentz Transformation for engineering applications.
8. To demonstrate the quantum mechanical ideas – Lab

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) (AB 205), 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

Physics 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 and Optoelectronic Devices	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. Sources-LED & Laser Diode, Detectors-Photodetectors- PN & PIN - Applications of fiber optics in communication- Endoscopy.

Module: 7	Special Theory of Relativity	**9 hours**
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. Arthur Beiser et al., Concepts of Modern Physics, 2013, Sixth Edition, Tata McGraw Hill. William Silfvast,
2. Laser Fundamentals, 2008, Cambridge University Press
3. D. J. Griffith, Introduction to Electrodynamics, 2014, 4th Edition, Pearson
4. Djafar K. Mynbaev and Lowell L. Scheiner, Fiber Optic Communication Technology, 2011, Pearson

Reference Books

1. Raymond A. Serway, Clement J. Mosses, Curt A. Moyer Modern Physics, 2010, 3rd Indian Edition Cengage learning.
2. John R. Taylor, Chris D. Zafiratos and Michael A. Dubson, Modern Physics for Scientists and Engineers, 2011, PHI Learning Private Ltd.
3. Kenneth Krane Modern Physics, 2010, Wiley Indian Edition.
4. Nityanand Choudhary and RichaVerma, Laser Systems and Applications, 2011, PHI Learning Private Ltd.
5. S. Nagabhushana and B. Sathyanarayana, Lasers and Optical Instrumentation, 2010, I.K. International Publishing House Pvt. Ltd.
6. R. Shevgaonkar, Electromagnetic Waves, 2005, 1st Edition, Tata McGraw Hill
7. Principles of Electromagnetics, Matthew N.O. Sadiku, 2010, Fourth Edition, Oxford
8. Ajoy Ghatak and K. Thyagarajan, Introduction to Fiber Optics, 2010, Cambridge University Press

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

List of Challenging Experiments (Indicative)

1.	Determination of Planck's constant using electrolumine scence process	2 hrs
2.	Electron diffraction	2 hrs
3.	Determination of wave length of laser source (He-Ne laser and diodelasers of Different wave lengths) using diffraction technique	2 hrs
4.	Determination of size offine particle using laser diffraction	2 hrs
5.	Determination of the track width (periodicity) in a written CD	2 hrs
6.	Optical Fiber communication (source+optical fiber+detector)	2 hrs
7.	Analysis of crystallite size and strain in a nano-crystalline film using X-ray diffraction	2 hrs
8.	Numerical solutions of Schrödinger equation (e.g. particle in a box problem) (can be given as an assignment)	2 hrs
9.	Laser coherence length measurement	2 hrs

10.	Proof for transverse nature of E.M. waves	2 hrs
11.	Quantum confinement and Heisenberg's uncertainty principle	2 hrs
12.	Determination of angle of prism and refractive index for various colour – Spectrometer	2 hrs
13.	Determination of divergence of a laser beam	2 hrs
14.	Determination of crystalline size for nanomaterial (Computer simulation)	2 hrs
15.	Demonstration of phase velocity and group velocity (Computer simulation)	2 hrs
Total Laboratory Hours		**30 hours**

Mode of assessment: CAT / FAT			
Recommended by Board of Studies	04.06.2019		
Approved by Academic Council	55th ACM	**Date**	13.06.2019

PHY1999	INTRODUCTION TO INNOVATIVE PROJECTS	L	T	P	J	C
		1	0	0	4	2
Pre-requisite	Nil	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:

1. To understand the various types of thinking skills.
2. To enhance the innovative and creative ideas.
3. To find out a suitable solution for socially relevant issues-J component

Module: 1A	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 acontributor Forthe 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. **(non-contact hours)**

Module: 1B	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 atleast 50 people belonging to various strata of life and talk to them / make field visits to identify a min. of 100 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: 1C	Lateral Thinking Skill	1 hour

Blooms Taxonomy–HOTS–Out of the box thinking–de Bono lateral thinking model–Examples

Project : Last weeks-incomplete portion to be done and uploaded

Module: 2A	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: 2B	Brain storming	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 for the next 5 issues (issue 6–10). **(4 non-contact hours)**		
Module: 4A	**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: 4B	**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" celebration sup load the weeks learning out come.		
Module: 5A	**Innovation**	**1 hour**
Difference between Creativity and Innovation–Examples of innovation–Being innovative. **Project:** A literature searches on proto typing of your solution finalized. Prepare a proto type model or process and upload. **(4 non-contact hours)**		
Module: 5B	**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: 5C	**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: 6A	**Innovation in India**	**1 hour**
Stories of 10 Indian innovations **Project:** Making the project better with add ons. **(4 non- contact hours)**		
Module: 6B	**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: 7A	**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: 8A	**Contemporary issue in Innovation**	**1 hour**
Contemporary issue in Innovation **Project:** Final project Presentation, Vivavoce Exam **(4 non-contact hours)**		
Total Lecture hours		**15 hours**
Text Book(s)		
1. How to have Creative Ideas, Edward debone, Vermil on 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	39th ACM	**Date**	17.12.2015

CHI1001	CHINESE FOR ENGINEERS	L	T	P	J	C
		2	0	0	0	2
		Syllabus version				
		1.0				

Course Objectives:

The course gives students the necessary background to:

1. Develop Chinese cross-cultural communicative competence.
2. Understand basic language materials related to common daily settings.
3. Gain introductory Chinese cultural knowledge

Expected Course Outcome:

The students will be able to:

1. Remember greeting people in Chinese and use of personal pronouns and interrogative pronouns
2. Remember family names and understand yes – no question and correct use of phonetics
3. Create expressions related to nationality, place of origin and special questions.
4. Remember Occupations in Chinese, Adverbials of time and place and noun and pronouns
5. Create expressions related to age, numbers, special questions in Chinese

Module: 1		**3 hours**

• Greetings (Learn the basic ways to greet people, and tell one's own name and other's name)
• The personal pronouns"你，我，他/她，您，您们"

Module: 2		**3 hours**

• Question with the interrogative pronoun."谁"
• Phonetics: Syllable initials:/ n// h/; Syllable finals:/ a //o// e//i/;Tones: /1// 2 // 3/ /4/

Module: 3		**4 hours**

• Family names, given names (Learn to ask and tell Family names, given names)
• Special questions with"什么"
• The yes-no questions
• Phonetics: Syllable initials:/ b/ / p/ /m/; Syllable finals::/ ai // ao//ei//en/

Module: 4		**3 hours**

• Nationality and place of one's origin (Learn to ask and tell one's Nationality and origin)
• Using "不" to express negation

Module: 5		**3 hours**

• Special questions with "哪儿"or "什么地方"
• Phonetics: Syllable initials: / b/ / p/ /m/; Syllable finals: /ai // ao// ei// en/

Module: 6		**6 hours**

• Occupations (Learn to ask and tell one's occupation)
• Adverbials of time and place
• Noun/pronoun+"的"+noun
• Phonetics: Syllable initials:/ d//t/ /f/; Syllable finals: /u // an// ie //uo/

Module: 7		**6 hours**

• Age (Learn to ask and tell one's age)
• The numerals

• The special questions with "几" • Phonetics: Syllable initials:/l//g//x/; Syllable finals: /ang //ong//iang// iong/		
Module: 8	**Guest Lectures / Native Speakers**	**2 hours**
	Total Lecture hours	**30 hours**

Text Book(s)

1. Great Wall Chinese---Essentials in Communication By Beijing Language and Culture University Press

Reference Books

1. Liu Xun , (2002) 《New Practical Chinese Reader》 Worbook-1, Beijing, Beijing Language and Culture University Press, ISBN 7-5619-1042-8
2. Liu Fuhua, (2005) 《Chinese Paradise》 Teacher's Book-1, Beijing, Beijing Language and Culture University Press, ISBN 7-5619-1440-0
3. Chen Bo, (2003) 《Learn Chinese With Me》 Teacher's Book-1, Beijing, People's Education Press, ISBN7-107-16684-6
4. Zhai Xun (2007) 《Step By Step Chinese》Intensive Chinese Elementary, Beijing, Sinolingua, ISBN7-80200-261-6
5. Ma Jianfei (2006)《Great Wall Chinese---Essentials in Communication》 Workbook, Beijing, Beijing Language and Culture University Press, ISBN 7-5619-1622-1
6. Jiang Liping (2014) 《HSK Standard Course 1》Beijing, Beijing Language and Culture University Press, ISBN7-5619-3709-9

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

Recommended by Board of Studies	17.06.2016		
Approved by Academic Council	41st ACM	**Date**	17.06.2016

ESP1001	ESPAÑOL FUNDAMENTAL	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	Nil	Syllabus version				
		v.				

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

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.	**5 hours**
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.	**4 hours**
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 Goyal Publication; reprinted Edition, (2010)

Reference Books

1. "¡Acción Gramática!" Phil Turk and Mike Zollo, Hodder Murray, London 2006.
2. "Practice makes perfect: Spanish Vocabulary", Dorothy Richmond, McGraw Hill Contemporary, USA, 2012.
3. "Practice makes perfect: Basic Spanish", Dorothy Richmond, McGraw Hill Contemporary, USA 2009.
4. "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	41st ACM	**Date**	17.06.2016

ESP2001	ESPAÑOL INTERMEDIO	L	T	P	J	C
		2	0	2	0	3
Pre-requisite		Syllabus version				
		v.				

Course Objectives:

The course gives students the necessary background to:

1. Enable students to read, listen and communicate in Spanish in their day to day life.
2. Enable students to describe situations by using present, past and future tenses in Spanish.
3. Enable to develop the comprehension skill in Spanish language.

Expected Course Outcome:

The students will be able to

1. Create sentences in near future and future tenses and correctly using the prepositions like POR and PARA
2. Create sentences in preterito perfecto and correctly use the direct and indirect object pronouns
3. Create sentences related to likes and dislikes and also give commands in formal and informal way
4. Create sentences in past tense by using imperfect and idefinido forms and describe past events
5. Create conversations in Spanish at places like restaurants, hotels, Shops and Railway stations
6. Understand about different Spanish speaking countries and its culture and traditions.

Module: 1	Números (101 – 1 millón). Expresar los planes futuros. Los númerosordinales.	7 hours

Competencia Gramática: Futuros cercanos (Ir+a+Infinitivo). Futuros (Verbos regulares e irregulares).Uso del POR y PARA.
Competencia Escrita: Traducción ingles a español y español a Ingles.
Comprensión - Los textos y Videos

Module: 2	Las ropas, colores y tamaños. Costar, valer, descuentos y rebajas	8 hours

Competencia Gramática: Pronombres objetivos directos e indirectos. El verbo Gustar y Disgustar.
Competencia Escrita: Traducción ingles a español y español a Ingles. Comprensión - Los textos y Videos

Module: 3	Escribir un Correo electrónico formal e informal.	7 hours

Competencia Gramática: Imperativos formales e informales. Pretérito perfecto.
Competencia Escrita: Traducción ingles a español y español a Ingles.
Comprensión - Los textos y Videos

Module: 4	Currículo Vitae. Presentarse en una entrevista informal.	6 hours

Competencia Gramática: Pretérito imperfecto. Pretérito indefinido.
Competencia Escrita: Traducción ingles a español y español a Ingles.
Comprensión - Los textos y Videos

Module: 5	Introducción personal, Expresar los planes futuros.	5 hours

Comprensión oral: Introducción personal, Expresar los planes futuros. ¿Qué vas a hacer en las próximas vacaciones?
Comprensión auditiva: Las preguntas sobre un cuento auditivo. Relacionar el audio con las imágenes. Las preguntas basadas en canciones.
Medio de transporte: Comprar y Reservar billetes.

Module: 6	**Diálogos entre dos**	**5 hours**
Comprensión oral: Diálogos entre dos (cliente y tendero de ropas, pasajero y empleado, en un restaurante, Reservación de habitación en un hotel). Presentación en una entrevista. Comprensión auditiva: Las preguntas basadas en canciones. Las preguntas basadas en diálogos.		
Module: 7	**Presentación de los países hispánicos**	**5 hours**
Comprensión oral: Dialogo entre un médico y paciente. Presentación de los países hispánicos. Describir su infancia. Describir vacaciones últimas o las actividades de último fin de semana. Comprensión auditiva: Rellenar los blancos del cuento en pasado. Las preguntas basadas en el cuento. Las preguntas basadas en un anuncio		
Module: 8	**Guest Lectures / Native Speakers**	**2 hours**
Total Lecture hours		**45 hours**

Text Book(s)

1. "Aula Internacional 1", Jaime Corpas, Eva Garcia, Agustin Garmendia, Carmen Soriano Goyal Publication; reprinted Edition, Delhi (2010)

Reference Books

1. "¡Acción Gramática!" Phil Turk and Mike Zollo, Hodder Murray, London 2006.
2. "Practice makes perfect: Spanish Vocabulary", Dorothy Richmond, McGraw Hill Contemporary, USA, 2012.
3. "Practice makes perfect: Basic Spanish", Dorothy Richmond, McGraw Hill Contemporary, USA 2009.
4. "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	41st ACM	**Date**	17-06-2016

FRE1001	FRANÇAIS QUOTIDIEN	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	NIL	Syllabus version				
		1				

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

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 lectures**	**2 hours**
Guest lectures / 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	41st ACM	**Date**	17.06.2016

FRE1002	FRANÇAIS FACILE (EASY FRENCH)	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	NIL	Syllabus version				

Course Objectives

The course gives students the necessary background to:

1. Acquaint the learners with the basics of French language.
2. Enable learners understand the sentence structures in French.
3. Use Information Technology and Multimedia for teaching of French.

Expected Course Outcome:

The students will be able to:

1. Create the basic communication by introducing and greeting in French language
2. Understand the gender of nouns and apply numerical in day to day life
3. Remember the various parts of speech and use them appropriately
4. Create basic sentences in French
5. Understand French language and French grammar for appreciating the aspects of French culture
6. Create the art of narration/ share information with others

Module: 1	**9 hours**

La conjugaison des verbes en *–er* – les pronoms sujets – les articles indéfinis – les nombres 1à 20.
Savoir-faire pour: saluer, et se présenter – épeler en français – communiquer en classe – utiliser des stratégies pour comprendre un texte en français – différencier le tutoiement du vouvoiement.

Module: 2	**7 hours**

Les verbes être et avoir – les adjectifs de nationalité – le lexique de l'identité – le lexique de l'expression des gouts et des intérêts – les nombres 21 à 100.
Savoir-faire pour: demander et donner des renseignements personnels – exprimer des objectifs – renseigner sur la nationalité.

Module: 3	**6 hours**

Le présent du verbe irrégulier – il y a/ il n'y a pas – les articles définis – les prépositions de lieu – les adjectifs qualificatifs.
Savoir-faire pour: décrire et qualifier une ville ou un quartier – localiser – exprimer la quantité.

Module: 4	**5 hours**

Les formes de la négation – les adjectifs possessifs – le lexique des liens de parenté – le lexique de loisirs.
*Savoir-faire pour:*parler de notre entourage – parler de la première impression que produit quelqu'un et de son caractère – présenter et décrire quelqu'un.

Module: 5	**6 hours**

Les verbes pronominaux – les adverbes de temps – le lexique des jours de la semaine et des moments de la journée.
Savoir-faire pour : parler de nos habitudes – exprimer l'heure – nous informer sur la fréquence, l'heure et le moment – exprimer la ressemblance et la différence.

Module: 6	**5 hours**

Les adjectifs interrogatifs- les adjectifs démonstratifs – les adjectifs du couleur- le future proche.
Savoir-faire pour: s'informer sur un produit – acheter et vendre un produit – expliquer comment on

s'habille – donner un avis sur la façon de s'habiller – parler du temps qu'il fait - Situer une action dans le futur.		
Module: 7		**5 hours**
Les pronoms compléments d'objet direct – les articles partitifs – le lexique des aliments – le lexique de la quantité - le passé composé – les marqueurs temporels du passé. *Savoir-faire pour*: Donner et demander des informations sur un plat – Commander dans un restaurant – parler de nos expériences et de ce que nous savons faire – parler de faits passés.		
Module: 8		**2 hours**
Guest Lectures / native speakers		
Total Lecture hours		**45 hours**

Text Book(s)

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

Reference Books

1. ALTER EGO 1, Méthode de français, Annie Berthet, Catherine Hugo, Véronique M. Kizirian, Béatrix Sampsonis, Monique Waendendries, Hachette livre, Paris, 2006.
2. ALTER EGO 1, Le cahier d'activités, Annie Berthet, Catherine Hugo, Béatrix Sampsonis, Monique Waendendries, Hachette livre, Paris, 2006.

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

Recommended by Board of Studies	26.02.2016		
Approved by Academic Council	41st ACM	**Date**	17.06.2016

FRE2001	FRANÇAIS PROGRESSIF	L	T	P	J	C
		2	0	2	0	3
Pre-requisite	**Français Quotidien**	**Syllabus version**				
		v.1				

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 expressions in French.
2. Create senteces 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.

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 lectures**	**2 hours**
Guest lectures / 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	41st ACM	**Date**	17.06.2016

GER1001	GRUNDSTUFE DEUTSCH	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	Nil	Syllabus version				
		v.1				

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.

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		
Lagune, Hartmut Aufderstrasse, Jutta Müller, Thomas Storz, 2012. Deutsche Sprachlehre für Ausländer, Heinz Griesbach, Dora Schulz, 2013 Studio d A1, Hermann Funk, Christina Kuhn, CorneslenVerlag, Berlin: 2010 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	41st ACM	**Date** 17.06.2016

GER2001	MITTELSTUFE DEUTSCH	L	T	P	J	C
		2	0	2	0	3
Pre-requisite	**Grundstufe Deutsch**	**Syllabus version**				
		v.1				

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 communication related to simple and routine tasks.

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 advanced Level**	**5 hours**

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. Tangram Aktuell II, Rosa Maria Dallapizza, Beate Blüggel, Max Hueber Verlag, München : 2010

Reference Books

1. Themen Aktuell, Heiko Bock, Mueller Jutta, Max Hueber 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 Huerber Verlag, München : 2011

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

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	41stACM	**Date**	17.06.2016

ITL1002	ITALIANO DI BASE (BASIC ITALIAN)	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	**NIL**	**Syllabus version**				
		1.0				

Course Objectives:

The course gives students the necessary background to:

1. Enable the students to communicate in Italian in their day to day life
2. Enable the students to describe in simple terms (both in written and oral form) aspects of their background, immediate environment and matters in areas of immediate need
3. Enable the students to understand crucial aspects of Italian culture and civilization.

Expected Course Outcome:

The students will be able to

1. Apply Italian language in simple everyday conversation.
2. Analyze the evolution of Modern European languages, understanding the important connections between English and Neo-Latin languages.
3. Apply Italian language in simple written interaction and becoming more conscious and confident in the usage of their English vocabulary derived from Latin and Italian.
4. Understand important cultural aspects and socio-economic issues in contemporary Europe, developing their aptitude for critical thinking and adopting an internationally-oriented approach in learning.
5. Understand the concept of Made in Italy, concerning the world-renowned Italian design, fashion, food, manufacturing, craftsmanship, and engineering industries.

Module: 1	**L'alfabeto; salutare e presentarsi; nazionalità e numero di telefono (1-20)**	**3 hours**

Communicative functions: saluti formali (*Lei*), saluti informali (*tu*), chiedere e fornire dati personali.
Grammar skills: syllable stress, -ch/c & gh/g, pronomi soggetto (singolare), aggettivi di nazionalità (singolare), articoli *il/la*, verbi *essere/chiamarsi* (singolare).

Module: 2	**Professioni, stati d'animo, lingue parlate, numeri (1-100)**	**4 hours**

Communicative functions: presentare un'altra persona, forma interrogativa, età.
Grammar skills: articoli determinativi/indeterminativi, dimostrativi *questo/questa*, preposizioni *a/in*, interrogativi *che/chi/dove/quanti*, verbo *avere*, possessivi *mio/mia*.
Written communication skills: presentare se stessi e altre persone.

Module: 3	**Cibi e bevande. Gli oggetti della cucina**	**3 hours**

Communicative functions: ordinare al bar o al ristorante, chiedere in modo cortese.
Grammar skills: plurale dei sostantivi, indicativo presente dei verbi in *–ere*, i verbi *volere/preferire*, differenza *bene/buono*, interrogativi *che cosa, quali, quante*.
Written communication skills: descrivere i propri cibi preferiti e quelli non graditi. Trascrivere un'ordinazione al ristorante.

Module: 4	**Tempo libero, attività abituali. La settimana e i mesi dell'anno. Dire l'ora e la data**	**5 hours**

Grammar Skills: verbi regolari in *–ire*, verbi irregolari *andare/uscire*, avverbi di frequenza, preposizioni *in/a/con*, uso del verbo *piacere/mi piace*, pronomi personali indiretti (singolare), l'interrogativo *perché*.

Written communication skills: descrivere il proprio tempo libero e le proprie attività abituali.		
Module: 5	**La casa e la stanza d'albergo. Descrizione di oggetti quotidiani e luoghi**	**4 hours**
Communicative functions: prenotare una stanza d'albergo, chiedere il prezzo, descrivere la casa e l'arredamento. **Grammar skills**: *c'è/ci sono*, i verbi irregolari *potere/venire*, preposizioni di tempo *da/a*, preposizioni articolate, numeri ordinali. **Written communication skills**: Descrivere la propria camera, fornire opinioni sui luoghi.		
Module: 6	**Muoversi in città. Le attività in città**	**3 hours**
Communicative functions: descrivere un luogo, descrivere un percorso, fornire indicazioni su spostamenti e orari di apertura di negozi e uffici. **Grammar skills**: *ci*+verbo *andare*, concordanza aggettivo-sostantivo, il partitivo, uso di *molto*, i verbi *dovere/sapere*, interrogativi *quando/quale*. **Written communication skills**: descrivere la propria città. Descrivere un percorso abituale.		
Module: 7	**Le vacanze. Riferire eventi passati. Fenomeni meteorologici. La famiglia. Le festività in Italia e gli orari lavorativi**	**6 hours**
Communicative functions: Raccontare un evento passato ed esprimere opinioni sui luoghi. Parlare del tempo atmosferico. Fare gli auguri. Descrivere una fotografia di famiglia. Parlare della propria famiglia. Esprimere possesso **Grammar skills**: Passato prossimo, participio passato regolare e irregolare, il superlativo assoluto, *tutto il/tutti i*. I verbi riflessivi, gli avverbi di frequenza, modi di dire con il verbo *fare*, aggettivi possessivi, passato prossimo dei verbi riflessivi. **Written communication skills**: Scrivere una email in cui si raccontano le proprie vacanze usando il passato prossimo. Traduzione italiano-inglese e inglese-italiano. Descrivo la mia festività preferita. Descrivo la mia famiglia.		
Module: 8	**Guest Lecture / Native Speakers**	**2 hours**
	Total Lecture hours	**30 hours**
Text Book(s)		
1. L. Ziglio, G. Rizzo, *Nuovo Espresso 1*, Alma Edizioni, Florence 2014		
Reference Books		
1. A. Mazzetti et al., Qui Italia 1. Lingua e grammatica, Le Monnier, Florence 2. M. Diaco et al., Spazio Italia 1 Livello A1, Loescher, Turin 2011. 3. C. Ghezzi et al., Nuovo Contatto A1, Loescher, Turin 2014.		

Recommended by Board of Studies	02.05.2018		
Approved by Academic Council	50th ACM	**Date**	14.06.2018

JAP1001	JAPANESE FOR BEGINNERS	L	T	P	J	C
For UG Programes		2	0	0	0	2
Pre-requisite	Nil	Syllabus version				
		1				

Course Objectives:

The course gives students the necessary background to:

1. Develop four basic skills related to reading, listening, speaking and writing Japanese language.
2. Instill in learners an interest in Japanese language by teaching them culture and general etiquettes.
3. Recognize, read and write Hiragana and Katakana.

Expected Course Outcomes:

Students will be able to:

1. Remember Japanese alphabets and greet in Japanese.
2. Understand pronouns, verbs form, adjectives and conjunctions in Japanese.
3. Remember time and dates related vocabularies and express them in Japanese.
4. Create simple questions and its answers in Japanese.
5. Understand the Japanese culture and etiquettes.

Module: 1	Introduction to Japanese syllables and Greetings	4 hours

Introduction of Japanese language, alphabets; Hiragana, katakana, and Kanji Pronunciation, vowels and consonants.

Hiragana – writing and reading; Vocabulary: 50 Nouns and 20 pronouns, Greetings.

Module: 2	Demonstrative Pronouns	4 hours

Grammar: N1 wa N2 desu, Japanese Numerals, Demonstrative pronoun - Kore, Sore, Are and Dore

(This, That, Over there, which) Kono, sono, Ano and Dono (this, that, over there, which) Kochira, Sochira, Achira and Dochira. this way....) Koko, Soko, Asoko and Doko (Here, There…. location)

Module: 3	Verbs and Sentence formation	4 hours

Classification of verbs Be verb desu Present and Present negative Basic structure of sentence (Subject+ Object+Verb) Katakana-reading and writing

Module: 4	Conjunction and Adjectives	4 hours

Conjunction-Ya…..nado Classification of Adjectives 'I' and 'na'-ending Set phrase – Onegaishimasu – Sumimasen,

wakarimasen Particle –Wa, Particle-Ni 'Ga imasu' and 'Ga arimasu' for Existence of living things and non-living things

Particle- Ka, Ni, Ga

Module: 5	Vocabulary and its Meaning	4 hours

Days/ Months /Year/Week (Current, Previous, Next, Next to Next) ; Nation, People and Language Relationship of family (look and learn); Simple kanji recognition

Module: 6	Forming questions and giving answers	4 hours

Classification of Question words (Dare, Nani, Itsu, Doyatte, dooshite, Ikutsu, Ikura); Classification of Te forms, Polite form of verbs

Module: 7	**Expressing time, position and directions**	**4 hours**
Classification of question words (Doko, Dore, Dono, Dochira); Time expressions (Jikan), Number of hours, Number of months, calendar of a month; Visit the departmental store, railway stations, Hospital (Byoki), office and University		
Module: 8	**Guest Lecture by Experts**	**2 hours**
Total Lecture hours		**30 hours**

Text Book(s):

1. The Japan Foundation (2017), Marugoto Japanese Language and Culture Starter A1 Course book For Communicative Language Competences, New Delhi: Goyal Publishers (9788183078047)
2. Banno, Eri et al (2011), Genki: An Integrated Course in Elementary Japanese I [Second Edition], Japan: The Japan Times.

Reference Book(s):

1. Japanese for Busy people (2011) video CD, AJALT, Japan.
2. Carol and Nobuo Akiyama (2010), The Fast and Fun Way, New Delhi: Barron's Publication

Mode of Evaluation: CAT , Quiz and Digital Assignments

Recommended by Board of Studies	24.10.2018		
Approved by Academic Council	53rd ACM	**Date**	13.12.2018

STS1001	INTRODUCTION TO SOFT SKILLS	L	T	P	J	C
		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:

1. Enabling students to know themselves and interact better with self and environment

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

STS1002	INTRODUCTION TO BUSINESS COMMUNICATION	L	T	P	J	C
		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:

1. Enabling students enhance knowledge of relevant topics and evaluate the information

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
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**
Strengthening 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

STS2001	REASONING SKILL ENHANCEMENT	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2				

Course Objectives:

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

Expected Course Outcome:

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

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

STS2002	INTRODUCTION TO ETIQUETTE	L	T	P	J	C
		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.

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, Bangalore.

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., Bangalore.
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

STS2101	GETTING STARTED TO SKILL ENHANCEMENT	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				

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

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	13 hours

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, 1stEdition, McGraw-Hill Education Pvt. Ltd.
3. **SMART, Place Mentor, 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):

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

STS2102	ENHANCING PROBLEM SOLVING SKILLS	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				

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

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):

1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.
2. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt. Ltd.
3. SMART, Place Mentor, 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):

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

STS2201	NUMERICAL SBILITY AND COGNITIVE INTELLIGENCE	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				

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

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):

1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.
2. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt. Ltd.
3. SMART, Place Mentor, 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):

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

STS2202	ADVANCED APTITUDE AND REASONING SKILLS	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				

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

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):

1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.
2. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt. Ltd.
3. SMART, Place Mentor, 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):

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

STS3001	PREPAREDNESS FOR EXTERNAL OPPORTUNITIES	L	T	P	J	C
		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:

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

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

STS3004	DATA STRUCTURES AND ALGORITHMS	L	T	P	J	C
		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:

1. Clear knowledge about problem solving skills in DS & Algorithms concepts

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

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

STS3005	CODE MITHRA	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2				

Course Objectives:

1. To develop logics which will help them to create programs, applications in C.
2. To learn how to design a graphical user interface (GUI) with Java Swing.
3. To present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively.

Expected Course Outcome:

1. Enabling students to write coding in C,C++,Java and DBMS concepts

Module: 1	C Programming	15 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: 2	C++ Programming	15 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, Interfaces.

Module: 3	JAVA	10 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.

Module: 4	Database	5 hours

Introduction to database, DDL, Data Manipulation, SELECT, Joins.

Total Lecture hours	45 hours

Reference Books

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

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

STS3006	PREPAREDNESS FOR RECRUITMENT	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2				

Course Objectives:

1. To enhance the problem solving skills.
2. To check if candidates have the adequate writing skills that are needed in an organization.
3. To reason, model, and draw conclusions or make decisions with mathematical, statistical, and quantitative information.

Expected Course Outcome:

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

Module: 1	Quantitative Ability	12 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	21 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.
Grammar
Spot the Errors, Sentence Correction, Gap Filling Exercise.

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 AC	**Date**	15.06.2017

STS3007	PREPAREDNESS FOR RECRUITMENT	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2				

Course Objectives:

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

Expected Course Outcome:

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

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

STS3101	INTRODUCTION TO PROGRAMMING SKILLS	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				

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

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 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)

STS3104	ENHANCING PROGRAMMING ABILITY	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				

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

Module: 1	Collections	12 hours

Array List, Linked List, List Interface, Hash Set, Map Interface, Hash Map, Set
Programming questions based on collections
Real world problems based on data structure

Module: 2	Threads, Exceptions, Linked List, Arrays	6 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

Module: 3	Stack and Queue, Trees	7 hours

Solving programming questions based on stacks and queues
How to implement a stack using queue?
How to implement a queue using stack?

Solving programming questions based on trees, binary trees, binary search trees

Module: 4	JDBC Connectivity, JDBC Data	10 hours

JDBC Overview
Database Setup
Install the MySQL Database
Create New Database User in MySQL Workbench
Selecting data from tables
Inserting Data into the Database
Updating Data in the Database
Deleting Data from the Database

Creating Prepared Statements		
Module: 5	**Networking with Java**	**10 hours**
Working with URLs Sending HTTP Requests Processing JSON data using Java Processing XML data using Java		
Total Lecture hours		**45 hours**
Reference Books		
1. Java The Complete Reference, 2014, 9th Edition 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)		

STS3105	COMPUTATIONAL THINKING	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				

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

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 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)

STS3201	PROGRAMMING SKILLS FOR EMPLOYMENT	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				

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

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**
Array List, Linked List, List Interface, Hash Set, Map Interface, Hash Map, 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 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)		

STS3204	JAVA PROGRAMMING AND SOFTWARE ENGINEERING FUNDAMENTS	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				

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

Module: 1	Threads, Exceptions, Linked List, 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 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)		

STS3205	ADVANCED JAVA PROGRAMMING	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				

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

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	Linked List, 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 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)

STS3301	JAVA FOR BEGINNERS	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				

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

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 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)

STS3401	FOUNDATION TO PROGRAMMING SKILLS	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				

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

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 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)		

CLE1003	SURVEYING	L	T	P	J	C
		3	0	2	4	5
Pre-requisite	MAT1011 Calculus for Engineers	Syllabus version				
		1.0				

Course Objectives:

1. To provides basic knowledge about principles of surveying for location, design and preparation of maps.
2. To know the various methods involved in surveying like tachometric, curve setting, longitudinal and cross section.
3. To develop skills using surveying instruments including measuring tapes, compass, plane table, levels, theodolites, and GPS.
4. To get introduced to modern advanced surveying techniques such as total station, Remote sending, GPS, Photogrammetry and LIDAR

Expected Course Outcome:

On completion of this course the students will be able to:

1. Understanding basics involved in different types of surveying instruments and equipment like levels, theodolite, total station, GPS and LIDAR
2. Implement the skills in performing measurement of distances, angles, elevations and location.
3. Estimate the area of given plots and earthwork involved in cutting and fillings.
4. Prepare of longitudinal and cross sections, curve setting and 3D maps.
5. Execute project work related to surveying using modern instruments.

Module: 1	Measurements of Distance, Angles and Directions	6 hours

Importance of surveying - Classifications - principles, Chain and tape measurement – Meridians, Azimuths and bearings – compass - Theodolites – adjustments – Horizontal and Vertical angle measurements - Plane table surveying

Module: 2	Determination of Elevations	6 hours

Differential levelling, longitudinal & cross section levelling, refraction & curvature correction, reciprocal leveling

Module: 3	Determination of Distance and Elevations by Tacheometry	5 hours

Tacheometry – Stadia tacheometry, tangential tacheometry& substance tacheometry and Contouring

Module: 4	Calculation of Area and Volume	6 hours

Area - Computation, measurements from cross section - volume calculation from spot levels, earth work calculations, practical problems

Module: 5	Curve Surveying	6 hours

Definitions, designation of curve, elements of simple curve - settings of simple circular curve, compound and reverse curve- transition curve – Introduction to vertical curve

Module: 6	Modern Field Instruments	7 hours

Electronic Distance Measurement - Basic Principle – Classifications -Electro-optical system - computing distances – Electronic Total Station instruments – Types – Measurements with total station - Surveying with Global Positioning Systems (GPS); Field data collection through remote sensing and Photogrammetry

Module: 7	**Field Applications**	**7 hours**
Preparation of Topographic Map- Contour Map - TIN model and Generation of 3D Surface - Preparation of Longitudinal & cross section of roads using Software		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**45 hours**

Text Book (s)

1. Surveying and Levelling, Vol. I & II, by B. C. Punmia, Laxmi Publications, 2016.

Reference Books

1. Surveying Vol. I, II and III by Dr. K. R. Arora, Standard Book House. New Delhi Roy S. K. (2009), Fundamentals of Surveying, Prentice Hall of India.
2. Surveying and Levelling, by R. Subramaniyan, Oxford University Press 2014.
3. Satheesh Gopi (2005) GPS Principles and Applications, Tata McGraw Hill publishing company Ltd.

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

List of Challenging Experiments (Indicative)		
1.	Calculate the area of a given parcel of land by cross staff survey using chain surveying.	3 hours
2.	Find the two-dimensional coordinates of the survey points through traversing with prismatic compass and chain	3 hours
3.	Prepare the layout map of a given building using Plane Table Surveying	3 hours
4.	Horizontal & Vertical Angle measurement using Theodolite	3 hours
5.	Calculate the reduced level of points by rise and fall method and height of collimation method using dumpy level	3 hours
6.	Longitudinal and Cross Sectional leveling of a given road segment using dumpy level	3 hours
7.	Stadia tacheometry to find the distance and elevation	3 hours
8.	Tangential Tacheometry to find the distance and elevation	3 hours
9.	Setting out of a Simple Circular Curve	2 hours
10.	Contour map preparation using RLs calculated from staff readings of dumpy level	2 hours
11.	Distance and angular measurement and area calculation using total station	2 hours
Total Laboratory Hours		**30 hours**

Sample J component projects are listed below

Sl. No.	Projects
1.	Design and Working Multilevel Parking
2.	In Depth Focus on Future of Airport Planning, Design and Construction by Analyzing Current Issues
3.	Surveying of Footover Bridge
4.	Various Software to Analyze Surveying Data

5.	River Drainage Pattern and Construction of Reservoir		
6.	Design and Planning of an Airport		
7.	Rail Alignment		
8.	Highway Construction Survey		
9.	Construction of a Multi Level Toll Plaza		
10.	Harbor Designing		
11.	Survey for Stadium		
12.	Road Construction and Developing Effective Transportation Syatem		
13.	Modernisation of Cafeteria and Ease to Access It		
Mode of assessment: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test			
Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE1004	SOIL MECHANICS ANDFOUNDATION ENGINEERING	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	MAT1011 Calculus for Engineers	Syllabus version				
		1.0				

Course Objectives:

1.To impart the fundamental concepts of soil mechanics and understand the bearing capacity
2. To understand the concept of compaction and consolidation of soils
3. To understand the design aspects of foundation
4. To evaluate the stress developed in the soil medium
5. To study the stability of slopes

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Compare the various engineering and index properties of soil.
2. Explain the hydraulic conductivity of the soil and seepage actions.
3. Examine the stress distribution at any point below the ground level.
4. Evaluate the shear strength of the soil using Mohr Soil.
5. Discuss the soil investigation techniques for advanced explorations and to conduct the field test like SPT & PLT.
6. Evaluate the safe bearing capacity of shallow foundations
7. Estimate load carrying capacity of pile foundations and to compute the lateral earth pressure.

Module: 1	Soil Properties and Compaction	7 hours

Basic definitions; Phase relations; Index properties; Grain size distribution & Index properties; Soil Classification (IS)Compaction, Laboratory compaction tests & Factors affecting compaction.

Module: 2	Effective Stress Principle and Permeability	5 hours

Principle of effective stress; Capillarity; Seepage force and quicksand conditionOne-dimensional flow; Darcy's law; Laboratory methods for permeability determination.

Module: 3	Stress Distribution and Consolidation	7 hours

Boussinesq stress distribution theory and Newmarks chart Compressibility of soils, e-p data and stress history; Normally consolidated and over-consolidated soils; Terzaghi's theory of one-dimensional consolidation; Time-rate of consolidation; Evaluation of compressibility and consolidation parameters.

Module: 4	Shear Strength Behaviour	6 hours

Mohr's stress circle; Mohr-Coulomb failure criterion; Laboratory tests for shear strength determination; Effective and total stress shear strength parameters; Shear strength characteristics of clays and sands.

Module: 5	Soil Exploration	4 hours

Objective of site investigation– Detailed site investigation – Methods of exploration – Depth of exploration – Factors governing location and depth of foundation – Types of Foundations – Selection of Foundation. Preparation of soil investigation report

Module: 6	Bearing Capacity and Settlements of Shallow Foundations	8 hours

Terzaghi's theory of bearing capacity – General and local shear failure - Effect of Water table – Plate load test – Standard Penetration Test – Design of Footings – Settlement of footings - Immediate and

Time dependent settlement – Permissible limits of total and differential Settlement		
Module: 7	**Pile Foundations and Slope Stability**	**6 hours**
Classification and selection of piles – Static and dynamic formulae for single pile capacity – Efficiency and capacity of pile groups – Design of Pile group – Settlement of Pile Groups– Load test on piles Failure of infinite and finite slopes – Swedish circle method – Factor of safety - Slope stability of earth dams. Definitions – Earth pressure at rest – Rankine's active and passive earth pressures - Coulomb's earth pressure theories – Types of retaining walls		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**45 hours**

Text Book (s)

1. K. R. Arora, "Soil mechanics and Foundation Engineering" Std Publishers, New Delhi. 2011.

Reference Books

1. Braja M. Das, "Principles of Geotechnical Engineering", Cengage learning Pvt. Ltd, 8th Edition, 2014.
2. Holtz D. and Kovacs, W.D., "An Introduction to Geotechnical Engineering", Prentice Hall. 2nd Edition 2011.

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

List of Challenging Experiments (Indicative)

1.	Determination of Specific Gravity	2 hours
2.	Grain size Analysis – Mechanical Method	2 hours
3.	Consistency Limits i) Liquid Limit ii) Plastic Limit	2 hours
4.	Relative density	2 hours
5.	Compaction Test	2 hours
6.	Determination of Field Density	2 hours
7.	Coefficient of Permeability – Constant Head & falling head Method	3 hours
8.	Direct Shear Test	3 hours
9.	Unconfined compression Test	3 hours
10.	Vane shear test	3 hours
11.	Consolidation Test	3 hours
12.	California Bearing Ratio Test	3 hours
Total Laboratory Hours		**30 hours**

Mode of assessment: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE1006	ENVIRONMENTAL ENGINEERING	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	**MAT1011 Calculus for Engineers**	**Syllabus version**				
		1.0				

Course Objectives:

1. To teach students the basic principles and concepts of unit operations and processes involved in water and wastewater treatment
2. To develop a student's skill in the basic design of unit operations and processes involved in water and wastewater treatment
3. To develop a student's skill in evaluating the performance of water and wastewater treatment plants
4. To teach students the various methods of sludge management

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Quantify water required for a given population
2. Examine the type and size of reactor required for various unit operations and processes involved in water and wastewater treatment
3. Able to design individual unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.
4. Able to identify the type of unit operations and processes involved in water and wastewater treatment plants based on the water quality
5. Prepare the layout of water and wastewater treatment plants.
6. Evaluate the water and wastewater treatment plants
7. Investigate the performance of various unit operations and processes to meet the desired health and environment related goals.
8. Understand sludge management and disposal

Module: 1	**Introductions to water and wastewater treatment**	**3 hours**

Basics of water supply – Networks - forecasting methods. On site and centralized treatment systems, Water and wastewater quality parameters, Role of water and wastewater quality parameters and their standards

Module: 2	**Water and wastewater quality enhancement**	**5 hours**

Unit operations and unit processes, Concept and application of mass balance in reactor design, Fundamentals of process kinetics

Module: 3	**Physical treatment of surface water and groundwater**	**5 hours**

Sedimentation, filtration, adsorption and ion exchange, membrane

Module: 4	**Shear Strength Behaviour**	**4 hours**

Coagulation-flocculation; Chemical Softening; Chlorination; Oxidation

Module: 5	**Pre-and primary treatment of wastewater**	**3 hours**

Process flow sheet; Screen, grit removal, oil and grease removal, primary sedimentation

Module: 6	**Secondary Treatment of wastewater**	**6 hours**

Activated sludge process, conventional and extended aeration, trickling filters and biotowers, UASB process and other low cost system

Module: 7	**Wastewater and Sludge Disposal**	**2 hours**
Reuse systems, wastewater disposal on land and water bodies, and disposal of sludge		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**

Text Book (s)

1. Peavy, H.S., Rowe, D.R. and Tchobanoglous, G., "Environmental Engineering", McGraw Hill, 2013

Reference Books

1. Davis, M.L. and Cornwell, D.A., "Introduction to Environmental Engineering", McGraw Hill., 2013
2. Masters, G.M., "Introduction to Environmental Engineering and Science", Prentice Hall of India, 2008
3. Arcievala, S.J., "Wastewater Treatment for Pollution Control", Tata McGraw Hill., 2009
4. Metcalf and Eddy , Wastewater Engineering, Treatment and reuse, Tata McGraw-Hill Edition, Fourth edition., 2007
5. Hammer, M.J. and Hammer, M.J., "Water and Wastewater Technology", 7th Ed., Prentice Hall of India, 2011

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

List of Challenging Experiments (Indicative)

1.	Determination of pH, Turbidity and conductivity (IS 3025 Part 11, 10 and 14)	2 hours
2.	Determination of Hardness (IS 3025 Part 21); Determination of Alkalinity (IS 3025 Part 23)	2 hours
3.	Determination of Chlorides (IS 3025 Part 32)	2 hours
4.	Determination of Sulfates (IS 3025 Part 24)	2 hours
5.	Determination of fluoride (Standard Methods for examination of Water & Wastewater, APHA)	2 hours
6.	Determination of Optimum Coagulant dosage	2 hours
7.	Determination of residual chlorine and available chlorine in bleaching powder (IS 3025 Part 25 and 26)	2 hours
8.	Determination of Oil, and Grease (IS 3025 Part 39)	2 hours
9.	Determination of suspended, settleable, volatile and fixed solids (IS 3025 Part 15, 17, 18, and 19)	2 hours
10.	Determination Dissolved Oxygen and BOD for the given sample (IS 3025 Part 38 and 44)	2 hours
11.	Determination of COD for given sample (IS 3025 Part 58)	2 hours
12.	Determination of SVI of Biological sludge and microscopic examination	2 hours
13.	Determination of MPN index of given water sample (IS 5401 Part 1)	2 hours
14.	Estimation of Nitrate a in water using UV-Visible Spectrometer	2 hours
15.	Combined estimation of anions (Fluoride, Chloride, Bromide, Nitrate, Phosphate, Sulphate) in water using Ion Chromatography	2 hours

Total Laboratory Hours			**30 hours**
Sample projects for J component			**(60 hrs)**
1.	Design of advanced water and wastewater treatment units		
2.	Application of software in design of treatment units		
3.	Design and execution of experiments to generate data needed for design of various treatment reactors		
4.	Process development / modification		
5.	Application of nanomaterials in water and wastewater treatments		
6.	Understanding the problem of excessive use of nanomaterials – how this effect conventional treatment units		
7.	Water and wastewater quality analysis – identification of source of pollution with the help of mathematical models/software		
8.	Water quality modeling		
9.	Selection of treatment units – developing management models		
10.	Groundwater quality monitoring		
11.	Fabrication and evaluation of treatment units for diverse liquid waste		
12.	Integrated treatment units		
13.	Cost –benefit analysis of various treatment units – this will be done using existing data		
14.	Health monitoring of local Rivers		
15.	River water quality management		
Mode of assessment: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test			
Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE1007	CONSTRUCTION MATERIALS AND TECHNIQUES	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	**NIL**	**Syllabus version**				
		1.1				

Course Objectives:

1. To understand the role of civil engineers and accomplishment in civil engineering profession.
2. To understand the physical and mechanical properties of construction materials and their respective testing procedure.
3. To know the building materials available in market for construction purpose.
4. To learn the principles and methods to be followed in construction of various civil engineering structures.
5. To learn different types of scaffolding and centering in building construction.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the role of civil engineers and accomplishment in civil engineering
2. Identify the relevant physical and mechanical properties of construction materials.
3. Apply the modern construction materials and roofing materials appropriate to the climate and functional aspects of the buildings.
4. Describe the principles and methods involved in prefabricated construction.
5. Decide construction technique to be followed in brick, stone and hollow block masonry, concreting, flooring, roofing, plastering and painting etc
6. Apply various types of scaffolding and its applications in construction.

Module: 1	**Introduction to Civil Engineering**	**5 hours**

Role of Civil Engineers in Society; Outstanding accomplishments of the profession; Future trends. Techno-economic considerations

Module: 2	**Materials & its Properties**	**8 hours**

Physical and Mechanical properties of construction materials - commonly used types of stones - Tests for stones, road aggregates and concrete aggregates, properties of sand, BIS specification for testing of aggregates –Bricks – Properties and testing methods for Bricks, Recycled Aggregates- Cement-Cement – Manufacturing -wet and dry processes, constituents and constitution, properties - Types of cement – Testing of Cement

Module: 3	**Modern Construction Materials**	**6 hours**

Modern materials – Neoprene, thermocole, decorative panels and laminates, architectural glass and ceramics, ferrocement, PVC, polymer base materials, fibre reinforced plastics.

Module: 4	**Roofing Material**	**6 hours**

Structural Steel and Aluminium – Roofing Material – Physical descriptions of asbestos sheets, GI sheets, tubes and light weight roofing materials - Timber - Types, Seasoning and various products

Module: 5	**Prefabricated Construction**	**8 hours**

Prefabricated panels and structures – production, transportation and erection of structures- Types of projects; Stages of projects; Participants in projects and their role; Techno-economic considerations; Project failures and their causes - Case studies

Module: 6	**Construction Components**	**7 hours**
Principles of construction – Selection of suitable type of masonry – Reinforced brick work – Stone masonry – Hollow block masonry - Pointing and Plastering- its purpose – Damp proof Course (DPC)- Anti-termite measures and treatments-Construction Joints- need and materials used		
Module: 7	**Scaffolding**	**3 hours**
Types of scaffolding and centering-its suitability as per situations and the type of structures.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**45 hours**

Text Book (s)

1. Rangwala, (2016), Building construction, Charotar Publishers

Reference Books

1. Ken Ward-Harvey (2009)(fourth edition), Fundamental building materials, Universal Publisher.
2. Edward Allen, Joseph Iano (2013) Fundamentals of Building Construction; Materials and Methods, Willey Publications.
3. Rangwala, (2015), Engineering materials, Charotar Publishers.
4. Edward Allen, Joseph Iano (2014) (Sixth Edition), Fundamental building materials, John Wiley & sons inc (Publisher).

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE2001	BUILDING DRAWING	L	T	P	J	C
		1	0	2	4	3
Pre-requisite	CLE1007 – Construction Materials and Techniques	Syllabus version				
		1.0				

Course Objectives:

1. To understand the National Building Code regulations
2. To apply the AUTO CAD commands in layout and plans
3. To identify the requirements for various building components

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Examine the dimensions and describe the types of building.
2. Apply the AUTO CAD commands in preparation of detailed plan.
3. Identify the National Building Code standards for planning.
4. Understand all the parts of the structure and its standard sizes.
5. Explain the types of roof and roofing materials.
6. Design and develop a plan for residential and hospital building
7. Demonstrate and prepare a detailed plan for institutional and industrial buildings.

Module: 1	Introduction to Building Drawing	2 hours

Types of Buildings - Building Regulations as per Indian Standards - Drawing Tools - Standard Paper Size - BIS, ISO, Architecture and ANSI Specifications and Notations.

Module: 2	GUI of AutoCAD	2 hours

Basic Commands - 2D Drafting and Annotation - Sheets and Layouts - Blocks and Customizing AutoCAD. Introduction to Building Information Modeling

Module: 3	Building Planning	2 hours

Provisions of National Building Code - Building bye-laws - open area - setbacks - FAR terminology - Principles of planning - orientation - ventilation and lighting. Provisions for differently abled persons.

Module: 4	Building Elements	2 hours

Foundations - Plinth beam - Column- Beam - Slab- Lintel - Staircase - doors and windows - Types - Specifications - Standard sizes - Notations.

Module: 5	Roof Types	1 hour

Flat and Pitched roofs.

Module: 6	Planning of Residential and Hospital buildings	2 hours

Single bed room - double bed-room - multi-storey buildings - Hospitals buildings with Pharmacy and Dispensaries.

Module: 7	Institutional, Commercial and Industrial buildings	2 hours

School Building with Hostel - Workshop and Factory buildings with steel truss

Module: 8	Contemporary issues	2 hours

Total Lecture hours		**15 hours**
Text Book (s)		
1. Kumara Swamy N and Kameswara Rao A, "Building Planning and Drawing", Charotar Publishing House Pvt. Ltd., 2013.		
Reference Books		
1. Gurcharan Singh, "Civil Engineering Drawing", Standard Publishers, New Delhi, 2009. 2. Randy Shih, "Autocad 2016 Tutorial First Level - 2D Fundamentals", Schroff Development Corp, 2015. 3. Mark W. Huth Delmar, "Understanding Construction Drawings", Cengage Publishers, 2013. 4. National Building Code of India 2005, Reprint edition, Bureau of Indian Standards, Govt. of India, 2013.		
Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test		
Preparation of line sketches in accordance with functional requirements and building rules for the following types of building as per National Building Code:		
1.	Flat roof residential building	2 hours
2.	Pitched roof residential building	2 hours
3.	Multi-storeyed building	2 hours
4.	Industrial Building	2 hours
Detailed Drawings (Plan, Elevation and section for the following) by manual and by using AutoCAD:		
5.	Detailed drawing for doors, windows.	3 hours
6.	Planning, design and detail drawings of staircase	3 hours
7.	Flat roof building with load bearing wall	4 hours
8.	Pitched roof with load bearing wall	4 hours
9.	Framed structures	4 hours
10.	Industrial Building with North light roof truss	4 hours
Total Lecture hours		**30 hours**

Sl. No.	**Sample project titles for J component**	**(60 hours)**
1.	Prepare the detailed plan for Primary health center	
2.	Prepare the detailed plan for a hostel building	
3.	Prepare the detailed plan for a secondary school building	
4.	Prepare the detailed plan for a manufacturing industry	
5.	Prepare the detailed plan for a shopping mall	
6.	Prepare the detailed plan for a library building	
7.	Prepare the detailed plan for apartments	

Recommended by Board of Studies	16.08.2017		
Approved by Academic Council	46th ACM	**Date**	24.08.2017

CLE2002	STRENGTH OF MATERIALS	L	T	P	J	C
		2	2	2	0	4
Pre-requisite	MEE1002 – Engineering Mechanics	Syllabus version				
		1.1				

Course Objectives:

1. To provide the basic concepts and principles of strength of materials.
2. To give an ability to calculate stresses and deformations of objects under external loadings.
3. To give an ability to apply the knowledge of strength of materials on engineering applications and design problems.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the fundamental concepts of stress and strain
2. Evaluate the problems relating to pure and uniform bending of beams and other simple structures
3. Examine the deflection of beams under various loading condition.
4. Understand the concept of hoop and radial stress in design of thin and thick cylinders
5. Solve torsional deformation of Shafts
6. Understand the concept of crushing and buckling
7. Analyse the structural elements using Energy methods

Module: 1	Simple Stresses and Strains	5 hours

Stress - Strain-types of stresses and strain - Hooke's law - tension -compression and shear – stress - strain diagrams - relation between elastic constants - Hoop stress - composite bars in tension and compression - Principle of superposition - bars of varying sections and of different materials - Thermal stresses and strains - principal stresses and strains - Mohr's circle. Theory of failures.

Module: 2	Shear Force and Bending Moment	5 hours

Beams and Bending - Types of loads, supports - Shear Force and Bending Moment Diagrams for statically determinate beam with concentrated load, uniformly distributed load, uniformly varying load - Point of Contra flexure - Theory of Simple bending - Distribution of bending stresses and shear stress.

Module: 3	Deflection of Beams	5 hours

Slope and deflection of beams - Macaulay's method - Moment area method - Conjugate beam method.

Module: 4	Thin and Thick Shells	3 hours

Introduction - Thin Cylindrical shells - hoop stress - longitudinal stresses - Lame's theory - Design of thin & thick cylindrical shells.

Module: 5	Torsion in circular shaft	3 hours

Torsion - Torsion equation - solid and hollow circular shaft - Torsional rigidity - power transmitted by the shafts

Module: 6	Theory of Columns	3 hours

Theory of columns - Long column and short column - Euler's formula - Rankine's formula -

Secant formula - Beam column		
Module: 7	**Introduction to determinate and indeterminate structures**	**4 hours**
Castigliano's I theorem - unit load method - Maxwell-Betti theorem		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**
Tutorial • A minimum of 3 problems to be worked out by students in every tutorial class. • 5 problems to be given as homework per tutorial class.		**30 hours**
Tutorial Class for Module 1 Tutorial Class for Module 2 Tutorial Class for Module 3 Tutorial Class for Module 4 Tutorial Class for Module 5 Tutorial Class for Module 6 Tutorial Class for Module 7		

Text Book (s)

1. R Subramanian, Strength of Materials, Oxford University Press, 2010

Reference Books

1. Gere, J.M. and Goodno, B.J., "Strength of Materials", Indian Edition (4th reprint), Cengage Learning India Private Ltd., 2009.
2. Beer, F.P., Johuston, Jr., E.R., Dewolf, J.T. and Mazureu, D.E., "Mechanics of Materials", Fifth Edition, McGraw Hill, 2009.
3. Timoshenko, S.P. and Young, D.H., "Elements of Strength of Materials", Fifth Edition, (In MKS Units), East-West Press Pvt. Ltd., 2009.
4. Bansal R. K, "Strength of Materials", Laxmi Publications, 2010.

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Sl. No.	Laboratory Exercises	hours
1.	Tension test on steel for finding stress and strain and E.	3 hours
2.	Construction of Mohr's circle using principle stress.	3 hours
3.	Sketching a shear force and bending moment diagrams for different types of beams with different loading conditions	4 hours
4.	Torsion test	4 hours
5.	Shear stress	4 hours
6.	Bending stress	4 hours
7.	Finding the deflection of beams	4 hours
8.	Load carrying capacity of long and short columns.	4 hours
Total Lecture hours		**30 hours**

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE2003	STRUCTURAL ANALYSIS	L	T	P	J	C
		2	2	0	0	3
Pre-requisite	CLE2002 – Strength of Materials	Syllabus version				
		1.1				

Course Objectives:

1. The course will help the students understand the concepts of indeterminacy of structural elements, analysis of the structures, drawing shear force and bending moment diagrams.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Determine the static and kinematic indeterminacy of beam, truss and frame.
2. Analyse propped cantilevers, fixed and continuous beams
3. Analyse indeterminate beams, pin and rigid jointed structures with and without temperature effect.
4. Understand the concepts of slope deflection method for beams and portal frame.
5. Analyse continuous beams and portal frame using moment distribution method
6. Draw influence line diagrams for determinate and indeterminate beams.
7. Analyse two hinged and three hinged arches

Module: 1	Introduction to Civil Engineering	2 hours
Static and kinematic indeterminacy - Beam - Truss - Frame.		
Module: 2	**Shear Force and Bending Moment**	**2 hours**
Analysis of propped cantilevers - fixed and continuous beams - bending moment and shear force diagram.		
Module: 3	**Strain Energy Method**	**4 hours**
Static indeterminacy - analysis of indeterminate structures, beams, pin jointed and rigid jointed structures - temperature effect - bending moment and shear force diagram.		
Module: 4	**Slope Deflection Method**	**5 hours**
Kinematic indeterminacy - analysis of continuous beams and portals - bending moment and shear force diagram.		
Module: 5	**Moment Distribution Method**	**5 hours**
Analysis of continuous beams and portals - bending moment and shear force diagram.		
Module: 6	**Influence Lines**	**5 hours**
Influence lines for bending moment and shear force - Muller Breaslau's - principle - determinate and indeterminate beams - Maxwell's reciprocal theorem.		
Module: 7	**Analysis of Arches & Cables**	**5 hours**
Two hinged and three hinged arches - Cables tension forces in towers.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**

Tutorial • A minimum of 3 problems to be worked out by students in every tutorial class. • 5 problems to be given as homework per tutorial class. Tutorial Class for Module 1 Tutorial Class for Module 2 Tutorial Class for Module 3 Tutorial Class for Module 4 Tutorial Class for Module 5 Tutorial Class for Module 6 Tutorial Class for Module 7	**30 hours**

Text Book (s)
1. Reddy, C.S, "Structural Analysis", Tata McGraw Hill, 2010.

Reference Books
1. Bhavikatti S. S. “Structural Analysis 1”, Vikas Publishing House, Noida, 2011. 2. Punmia, B.C, Ashok Kumar Jain & Arun Kumar Jain, "Theory of Structures", Laxmi Publications, India, 2014. 3. Ramamrutham, S. "Theory of structures", Dhanpat Rai publications. 2011. 4. Hibbeler, R.C, "Structural Analysis", Pearson India, 2014.

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test			
Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE2004	WATER RESOURCE ENGINEERING	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	MEE1004 – Fluid Mechanics	Syllabus version				
		1.0				

Course Objectives:

1. To motivate the students to identify, formulate, solve the complex problem to manage the water resource related issues.
2. To prepare the students to synthesize data and technical concepts to apply in water resources engineering.
3. To develop the ability of the students to conduct appropriate experiments, analyse and interpret data and use engineering judgement to draw conclusions in water resources problems.
4. To get the exposure about the concept of irrigation and flood control.
5. To provide the students an opportunity to work as a part of a project team.
6. To train the students for a successful career in water resources engineers

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Identify the various components of hydrological cycle and the spatial and temporal variation of rainfall.
2. Determine the different methods and hydrological models to estimate the stream flow.
3. Examine the different techniques to calculate the probable maximum flood based on different returned period.
4. Evaluate the basic aquifer parameters and groundwater resources for different hydro-geological boundary conditions.
5. Understand the different methods of irrigation and find the optimum methods of irrigation for judicious use of water resources.
6. Examine different distribution system of irrigation canal and the basic design of lined and unlined irrigation canal.
7. Apply the mathematics, science and technology to design the minor irrigation structures to develop the command area.

Module: 1	Precipitation Measurement and Analysis	4 hours

Hydrologic cycle and budget, Precipitation variability, rainfall and snow measurement techniques, design of precipitation gauging network, Hydrologic Abstractions-Infiltration-evaporation-evapotranspiration-interception and depression storage, rain harvesting-design procedure.

Module: 2	Stream Flow	5 hours

Measurement of stream flow; factors affecting stream flow; hydrograph analysis, base flow separation, unit hydrograph and curve number methods of stream flow determination, synthetic unit hydrograph, hydrological modeling for stream flow estimation, methods for peak discharge estimation.

Module: 3	Flood Analysis	3 hours

Design flood estimation, frequency analysis, flood routing, storm drainage design, flood migration, flood damage analysis.

Module: 4	**Ground Water**	**4 hours**
Ground water hydrology, Application of Darcy's law and Aquifer characteristics, Models for Groundwater flow analysis, steady state well hydraulics – Fundamentals of unsteady state.		
Module: 5	**Irrigation Practices**	**5 hours**
Need for Irrigation in India, Scope, National Water Policy, Physical properties of soil that influence soil moisture characteristics – Concept of soil water potential and its components, Crop water requirements – Irrigation Scheduling – Irrigation efficiencies – Duty-Delta-base period, Surface and Subsurface methods of Irrigation, Standards for irrigation water, Water logging and consequences – Salinity and alkalinity-Reclamation		
Module: 6	**Canal Irrigation**	**4 hours**
Classification of canals, Alignment of canals, Design of rigid boundary canals, Lacey's and Tractive force concepts in canal design, lining of canals; Sediment transport in canals, River training		
Module: 7	**Irrigation Structure**	**3 hours**
Design procedure for – Canal Head works – Canal regulators – Canal drop – Cross drainage works – Canal Outlet – Escapes, Lining and maintenance of canals		
Module: 8	**Contemporary issues**	**2 hours**
	Total Lecture hours	**30 hours**

Text Book (s)

1. Subramanya. K., " Engineering Hydrology" McGraw Hill Education (India) Pvt. Ltd. (2013)
2. Santosh Kumar Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi, (2013)

Reference Books

1. Chow, V.T., Maidment, D. R. and Mays, W.L., (2010) "Applied Hydrology", TataMcGraw Hill Education Pvt. Ltd.
2. Punmia. B. C., Ashok Kumar Jain, Arun Kumar Jain and Pande Brij BasiLal, (2012) "Irrigation and Water Power Engineering", Laxmi Publications (P) Ltd.
3. Mays, L.W. (2010). Water Resources Engineering, John wiley and sons.
4. Rastogi A. K., (2011) "Numerical Groundwater Hydrology", Penram International Publishing (India) Pvt. Ltd.
5. Todd D.K. and Larry W. Mays (2005)"Groundwater Hydrology", John Wiley & Sons, Inc, New York.

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Laboratory exercises	
1. Models for Groundwater flow analysis	5 hours
2. Estimate seepage losses and reservoir losses.	5 hours
3. Seepage analysis using software	5 hours
4. Reservoir operation losses	5 hours
5. Flood analysis	5 hours

6. Rainfall runoff modeling			5 hours
Total			**30 hours**
Sl. No.	**Project Titles (J component)**		**hrs**
1.	Advanced rain water harvesting structures		**60 hrs**
2.	New methods of irrigation		
3.	Groundwater modeling using MODFLOW		
4.	Flood frequency analysis		
5.	Rainfall-runoff model		
Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE2005	TRANSPORTATION ENGINEERING	L	T	P	J	C
		2	0	0	4	3
Pre-requisite	CLE1007 – Construction Materials and Techniques	Syllabus version				
		1.0				

Course Objectives:

1. To expose the students with various transportation modes and their advantages and disadvantages
2. To facilitate students to decide highway alignment and design highway geometry.
3. To enable students to select suitable materials for highway pavements and design the pavement.
4. To explain students with various components of a railway track.
5. To prepare students to design railway track geometry.
6. To teach students to identify the alignment and length of airport runway and draw an airport layout.
7. To illustrate students with various components of a harbor.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Classify basic design of highway geometry according to the design specifications.
2. Design a flexible pavement using IRC method.
3. Describe various components of railways and their functions.
4. Design a railway geometry according to the design specifications.
5. Classify various components of an airport and identify the alignment and the required length of a runway.
6. Identify various components of a harbor and their functions.

Module: 1	Highway Engineering	8 hours

Introduction to Transportation Systems, Classification of Roads, Highway Planning - Road cross section - camber, gradient, Super elevation - Sight distance - Horizontal and Vertical curve.

Module: 2	Highway Materials and Pavement Design	4 hours

Highway materials – soil, aggregate, bitumen – testing and specifications - types of pavements – pavement design - pavement construction and maintenance.

Module: 3	Railway Engineering	3 hours

History and general features of Indian railways – Permanent way - Rails, sleepers, ballast and subgrade – types and functions

Module: 4	Geometric Design	4 hours

Geometric design of railway track - Curves and superelevation - Points and crossings -Railway stations and yards - Signaling and interlocking.

Module: 5	Airport Engineering	2 hours

Air transportation in India - Airport classifications - Airport site selection.

Module: 6	**Geometric design of Runway**	**5 hours**
Runway configurations – wind rose and orientation of runway - runway length - Corrections to runway length - runway geometric design – taxiway, exit taxiway, aprons, hangars – aircraft parking configuration and parking system - Landing and Visual aids		
Module: 7	**Harbour Engineering**	**2 hours**
Water transportation – Harbours and ports - Classification – Features of harbour – Breakwaters – Docks – Wet and dry docks – Jetties.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**

Text Book (s)

1. Highway Engineering by S.K. Khanna, C.E.G. Justo, A. Veeraragavan, 10th edition, published by Nemchand and Bro., Roorkee, (2014)
2. Railway Engineering by Rangwala, 25th edition, Charotar publishing house private limited, Anand, India, (2015)
3. Airport Planning and Design - S. K. Khanna, M. G. Arora & S. S. Jain; Nem Chand & Bros, 2012
4. Harbour, Dock & Tunnel Engineering- R. Srinivasan; Charotar Publishers, Ahmedabad, 2011

Reference Books

1. Planning & Design of Airports – Robert Horonjeff, Francis McKelvey; Tata Mc Grawhill, 2010.
2. Dock & Harbour Engineering – H. P. Oza & G. H. Oza; Charotar Publishers, Ahmedabad, 2013.
3. Railway Engineering 2nd Edition - Satish Chandra & M. M. Agarwal; Oxford University Press-New Delhi, 2013.

Project Titles (J component)	**hrs**
Challenging projects for Individual or a group will be given based on the basic and advancements in the course content.	**60 hrs**

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE3001	QUANTITY SURVEYING AND ESTIMATING	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	CLE2001 – Building Drawing	Syllabus version				
		1.1				

Course Objectives:

1. To understand the types of estimates
2. To identify the methods used for different structural components
3. To understand rate analysis and process of preparation of bills

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the methods of estimates of buildings.
2. Understand the concepts of prepare a detailed estimate for different types of structures
3. Evaluate rate for various items of works in different types of structures.
4. Prepare valuation reports and cost quality control in construction

Module: 1	**Introduction- Methods of estimates**	**3 hours**
General items of work in building – standard units –principles of working out quantities for detailed and abstract estimates –methods of estimates of buildings.		
Module: 2	**Quantity Estimation for Building**	**6 hours**
Estimation of building - Short wall and long wall method - Centre line method - Report writing.		
Module: 3	**Quantity Estimation for Structural steel**	**5 hours**
Estimate of R.C.C and structural Steel - Scheduling - Slab - beam-column.		
Module: 4	**Quantity Estimation for Roads**	**4 hours**
Road estimation - earthwork fully in banking - cutting - partly cutting & partly filling - Detailed estimate and cost analysis for roads.		
Module: 5	**Analysis of Rates**	**4 hours**
Rate analysis & preparation of bills - Data analysis of rates for various items of works - Sub-structure components - Rate analysis for R.C.C. slabs, columns and beams.		
Module: 6	**Tenders and contracts**	**3 hours**
Tenders-Tender document - Cost & quality control - Contracts - Contracts - Types of contracts-Arbitration and legal requirements		
Module: 7	**Valuation**	**3 hours**
Valuation- Capitalized value - Depreciation - Value of building - Mortgage – Lease- Measurement book, Stores. BOT & EPC - Case studies.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**

Text Book (s)

1. Datta B.N. Estimating and costing, Charator Publishing House, 2012.

Reference Books			
1. Kohli D. D and Kohli R.C, "Estimating and Costing", 12th Edition, S. Chand Publishers, 2014. 2. Vazirani V. N and Chandola S. P, “Estimating and costing", Khanna Publishers, 2015. 3. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015. 4. Duncan Cartlidge, "Quantity Surveyor’s Pocket Book", Routledge Publishers, 2012. 5. PWD Data Book 6. CPWD Schedule of Rates (SoR) 7. Kohli D.D and Kohli R.C, "Estimating and Costing", 12th Edition, S. Chand Publishers, 2014.			
Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test			
Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE3002	BASICS OF STRUCTURAL DESIGN	L	T	P	J	C
		2	2	2	0	4
Pre-requisite	CLE2003 – Structural Analysis	Syllabus version				
		1.1				

Course Objectives:

1. To understand the basic concepts of Limit state design
2. To obtain the knowledge of using Indian standard codes and special publication.
3. To know the design concepts of all the structural members and learn economical design for materials saving
4. To know the design methodologies by limit state design for the beams, slabs, column and footings
5. To know the connections in steel structures by rivets and bolts
6. To learn the design of structural members such as compression and tension members

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Apply the usage of IS codes in design of reinforced concrete structures
2. Identify the types and design of beams and slabs
3. Design the uniaxial and biaxial bending of column.
4. Design the simple footings and combined footings
5. Develop skills in design of different types of steel connections.
6. Design the compression and tension member
7. Design the built-up-beam section

Module: 1	Introduction to Limit State method	4 hours

Introduction - Concept of limit state method - Analysis and design of singly and doubly reinforced rectangular and flanged beams.

Module: 2	Design of RC Slabs and Beams	4 hours

Design of different types of slabs - One way slab - two way slab – staircase

Module: 3	Design of RC Compression members	4 hours

Design of short column for axial load - uniaxial – Introduction to biaxial bending.

Module: 4	Design of RC Foundation	4 hours

Design of isolated and combined footing

Module: 5	Steel Sections and Types of Connections	5 hours

Introduction - properties of Rolled Steel Sections - permissible stress - Riveted and bolted connections – permissible stresses, efficiency - design for axial and eccentrically loaded members. Design of connections in tension members

Module: 6	Design of Tension and Compression members	3 hours

Types of sections – Net area – Net effective area of sections in tension –Slenderness ratio – Design of single section and compound section of compression members.

Module: 7	Valuation	4 hours
Design of beams - simple and built-up beams - laterally supported and unsupported beams, concept of shear. Plate and gantry girders – Flexural members.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**
Tutorial • A minimum of 3 problems to be worked out by students in every tutorial class. • 5 problems to be given as homework per tutorial class. Tutorial Class for Module 1 Tutorial Class for Module 2 Tutorial Class for Module 3 Tutorial Class for Module 4 Tutorial Class for Module 5 Tutorial Class for Module 6 Tutorial Class for Module 7		**30 hours**

Text Book (s)

1. Subramanian, N. "Design of Reinforced Concrete Structures", Oxford University Press, New Delhi, 2013.
2. Subramanian, N. "Steel Structures - Design and Practice", Oxford University Press, 2011.

Reference Books

1. Devadoss Menon and Pillai S., "Reinforced Concrete Design", McGraw Hill Education India Private Limited; 3rd edition 2009.
2. Raju N. Krishna, "Reinforced Concrete Design: Principles and Practice", CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2012.
3. Duggal, S. K, Limit State Design of Steel Structures, Tata McGraw-Hill Education, 2014.
4. IS 456: 2000 Plain and Reinforced Concrete - Code of Practice.
5. IS 800: 2007 General Constructions in Steel - Code of Practice.

Sl. No	Laboratory Exercises	L Hr.
1.	**RCC:** Design of doubly reinforced beams	3 hours
	Design of two way slabs	3 hours
	Design of short columns.	3 hours
	Design of combined footing	3 hours
	Design of staircases	3 hours
2.	**STEEL:** Design of Built up beams	4 hours
	Design of laterally supported and unsupported Beams	4 hours
	Design of gantry girders	4 hours
	Design of welded connections in framed structures	3 hours
		30 hours

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

MAT2002	APPLICATIONS OF DIFFERENTIAL AND DIFFERENCE EQUATIONS	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	MAT1011 - Calculus for Engineers	Syllabus Version				
		1.0				

Course Objectives

The course is aimed at

1. Presenting the elementary notions of Fourier series, which is vital in practical harmonic analysis
2. Imparting the knowledge of eigen values and eigen vectors of matrices and the transform techniques to solve linear systems, that arise in sciences and engineering
3. Enriching the skills in solving initial and boundary value problems
4. Impart the knowledge and application of difference equations and the Z-transform in discrete systems, that are inherent in natural and physical processes

Course Outcome

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

1. Employ the tools of Fourier series to find harmonics of periodic functions from the tabulated values
2. Apply the concepts of eigen values, eigen vectors and diagonalisation in linear systems
3. Know the techniques of solving differential equations
4. Understand the series solution of differential equations and finding eigen values, eigen functions of Strum-Liouville's problem
5. Know the Z-transform and its application in population dynamics and digital signal processing
6. Demonstrate MATLAB programming for engineering problems

Module: 1	Fourier series	6 hours

Fourier series - Euler's formulae - Dirichlet's conditions - Change of interval - Half range series – RMS value – Parseval's identity – Computation of harmonics

Module: 2	Matrices	6 hours

Eigenvalues and Eigen vectors - Properties of eigenvalues and eigen vectors – Cayley-Hamilton theorem - Similarity of transformation - Orthogonal transformation and nature of quadratic form

Module: 3	Solution of ordinary differential equations	6 hours

Linear second order ordinary differential equation with constant coefficients – Solutions of homogenous and non-homogenous equations - Method of undetermined coefficients – method of variation of parameters – Solutions of Cauchy-Euler and Cauchy-Legendre differential equations

Module: 4	Solution of differential equations through Laplace transform and matrix method	8 hours

Solution of ODE's – Nonhomogeneous terms involving Heaviside function, Impulse function - Solving nonhomogeneous system using Laplace transform – Reduction of nth order differential equation to first order system - Solving nonhomogeneous system of first order differential equations $(X' = AX + G)$ and $X'' = AX$

Module: 5	Strum Liouville's problems and power series Solutions:	6 hours

The Strum-Liouville's Problem - Orthogonality of Eigen functions - Series solutions of differential

equations about ordinary and regular singular points - Legendre differential equation - Bessel's differential equation		
Module: 6	**Z-Transform:**	**6 hours**
Z-transform-transforms of standard functions - Inverse Z-transform: by partial fractions and convolution method		
Module: 7	**Difference equations:**	**5 hours**
Difference equation - First and second order difference equations with constant coefficients - Fibonacci sequence - Solution of difference equations - Complementary function - Particular integral by the method of undetermined coefficients - Solution of simple difference equations using Z-transform		
Module: 8	**Contemporary Issues**	**2 hours**
Industry Expert Lecture		
	Total Lecture hours	**45 hours**

Text Book(s)

1. Advanced Engineering Mathematics, Erwin Kreyszig, 10th Edition, John Wiley India, 2015

Reference Books

1. Higher Engineering Mathematics, B. S. Grewal, 43rd Edition, Khanna Publishers, India, 2015
2. Advanced Engineering Mathematics by Michael D. Greenberg, 2nd Edition, Pearson Education, Indian edition, 2006

Mode of Evaluation: Digital Assignments (Solutions by using soft skills), Continuous Assessment Tests, Quiz, Final Assessment Test

1.	Solving Homogeneous differential equations arising in engineering problems	3 hrs
2.	Solving non-homogeneous differential equations and Cauchy, Legendre equations	3 hrs
3.	Applying the technique of Laplace transform to solve differential equations	3 hrs
4.	Applications of Second order differential equations to Mass spring system (damped, undamped, Forced oscillations), LCR circuits etc.	3 hrs
5.	Visualizing Eigen value and Eigen vectors	3 hrs
6.	Solving system of differential equations arising in engineering applications	3 hrs
7.	Applying the Power series method to solve differential equations arising in engineering applications	2 hrs
8.	Applying the Frobenius method to solve differential equations arising in engineering applications	2 hrs
9.	Visualising Bessel and Legendre polynomials	2 hrs
10.	Evaluating Fourier series-Harmonic series	2hrs
11.	Applying Z-Transforms to functions encountered in engineering	2 hrs
12.	Solving Difference equations arising in engineering applications	2 hrs
	Total Laboratory Hours	**30 hours**

Mode of Evaluation: Weekly Assessment, Final Assessment Test

Recommended by Board of Studies	25.02.2017		
Approved by Academic Council	47th AC	**Date**	05.10.2017

MAT3003	COMPLEX VARIABLES AND PARTIAL DIFFERENTIAL EQUATION	L	T	P	J	C
		3	2	0	0	4
Pre-requisite	MAT2002 Applications of Differential and Difference Equations	Syllabus Version				
		1.1				

Course Objectives:

The aim of this course is to present a comprehensive, compact and integrated treatment of two most important branches of applied mathematics for engineers and scientists namely the functions of complex variable and Partial differential equations in finite and infinite domains

Expected Course Outcome:

By the end of the course, the students are expected to

1. Construct analytic functions and find complex potential of fluid flow and electric fields
2. Find the image of straight lines by elementary transformations
3. Express analytic functions in power series
4. Evaluate real integrals using techniques of contour integration
5. Analyze partial differential equations, and its applications, design the boundary value problems (one dimensional heat and wave equations) and find Fourier series, Fourier transform techniques in their respective engineering problems

Module: 1	Analytic Functions	6 hours

Complex variable-Analytic functions and Cauchy – Riemann equations - Laplace equation and Harmonic functions - Construction of Harmonic conjugate and analytic functions - Applications of analytic functions to fluid-flow and Field problems.

Module: 2	Conformal and Bilinear transformations	5 hours

Conformal mapping - Elementary transformations-translation, magnification, rotation, inversion. Exponential and Square transformations ($w = e^z$, z^2) - Bilinear transformation - Cross-ratio-Images of the regions bounded by straight lines under the above transformations.

Module: 3	Power series	4 hours

Functions given by Power Series – Taylor and Laurent series – singularities – poles – Residues.

Module: 4	Complex Integration	5 hours

Integration of a complex function along a contour – Cauchy-Goursat theorem- Cauchy's integral formula -Cauchy's residue theorem - Evaluation of real integrals - Indented contour integral.

Module: 5	Partial Differential equations of first order	6 hours

Formation and solution of partial differential equation - General, Particular, Complete and Singular integrals - Partial Differential equations of first order of the forms: F(p,q)=0, F(z,p,q)=0, F(x,p)=G(y,q) and Clairaut's form - Lagrange's equation: Pp+Qq = R.

Module: 6	Applications of Partial Differential equations	10 hours

Linear partial differential equations of higher order with constant coefficients. Solution of a partial differential equation by separation of variables - Boundary Value Problems-one dimensional wave and heat equations- Fourier series solution.

Module: 7	Fourier transforms	7 hours

Complex Fourier transform and properties - Relation between Fourier and Laplace transforms -

Fourier sine and cosine transforms – Convolution Theorem and Parseval's identity.		
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 inventory Tutorial Class • Another 5 problems per Tutorial Class to be given as home work.	**30 hours**

Text Book(s)

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons (Wiley student Edison) (2015)

Reference Books

1. B. S. Grewal, Higher Engineering Mathematics, 42nd Edition (2013), Khanna Publishers, New Delhi
2. G. Dennis Zill, Patrick D. Shanahan, A first course in complex analysis with applications, 3rd Edition, 2013, Jones and Bartlett Publishers Series in Mathematics:
3. Michael, D. Greenberg, Advanced Engineering Mathematics, 2nd Edition, Pearson Education (2002)
4. Peter V. O' Neil, Advanced Engineering Mathematics, 7th Edition, Cengage Learning (2011)
5. JH Mathews, R. W. Howell, Complex Analysis for Mathematics and Engineers, Fifth Edition (2013), Narosa Publishers

Mode of Evaluation: Digital Assignments, Quiz, Continuous Assessments, Final Assessment Test.

Recommended by Board of Studies	16.08.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

MAT3005	APPLIED NUMERICAL METHODS	L	T	P	J	C
		3	2	0	0	4
Pre-requisite	MAT2002 – Applications of Differential and Difference Equations	Syllabus Version				
		1.1				

Course Objectives:

The aim of this course is to

1. Cover certain basic, important computer oriented numerical methods for analyzing problems that arise in engineering and physical sciences.
2. Use MATLAB as the primary computer language to obtain solutions to a few problems that arise in their respective engineering courses.
3. Impart skills to analyse problems connected with data analysis
4. Solve ordinary and partial differential equations numerically

Expected Course Outcome

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

1. Observe the difference between exact solution and approximate solution.
2. Use the numerical techniques to find the solution of algebraic equations and system of equations.
3. Fit the data using interpolation technique and spline methods.
4. Find the solution of ordinary differential equations, Heat and Wave equation numerically.
5. Apply calculus of variation techniques to extremize the functional and also find approximate series solution to ordinary differential equations

Module: 1	Algebraic and Transcendental Equations	5 hours

General iterative method- rates of convergence- Secant method - Newton – Raphson method- System of non-linear equations by Newton's method.

Module: 2	System of Linear Equations and Eigen Value Problems	6 hours

Gauss –Seidel iteration method. Convergence analysis of iterative methods-LU Decomposition - Tri diagonal system of equations-Thomas algorithm - Eigen values of a matrix by Power and Jacobi methods.

Module: 3	Interpolation	6 hours

Finite difference operators - Newton's forward-Newton's Backward- Central differences-Stirling's interpolation - Lagrange's interpolation - Inverse Interpolation-Newton's divided difference-Interpolation with cubic splines.

Module: 4	Numerical Differentiation and Integration	6 hours

Numerical differentiation with interpolation polynomials-maxima and minima for tabulated values-Trapezoidal rule, Simpsons $1/3^{rd}$ and $3/8^{th}$ rules. – Romberg's method. Two and Three point Gaussian quadrature formula.

Module: 5	Numerical Solution of Ordinary Differential Equations	8 hours

First and second order differential equations - Fourth order Runge – Kutta method. Adams-Bashforth-Moulton predictor-corrector methods. Finite difference solution for the second order ordinary differential equations.

Module: 6	**Numerical Solution of Partial Differential Equations**	**6 hours**
Classification of second order linear partial differential equations-Laplace equation –Gauss-Seidal method-One dimensional heat equation- Schmidt explicit method-Crank-Nicolson implicit method.-One dimensional wave equation–Explicit method.		
Module: 7	**Vibrational Methods**	**6 hours**
Introduction to calculus of variations -Definition of functional - Extremals of functional of a single dependent variable and its first derivative-Functional involving higher order derivatives-Functional involving several variables Isoperimetric problems-Galerkins method.		
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 for practise.	**30 hours**

Text Book(s)

1. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 6th Edition, 2012.
2. C. F. Gerald and P.V. Wheatley Applied Numerical Analysis, Addition-Wesley, 7th Edition, 2004.

Reference Books

1. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI Pvt. Ltd., 5th Edition, New Delhi, 2009.
2. W.Y. Yang, W. Cao, T.S. Chung and J. Morris, Applied Numerical Methods Using MATLAB, Wiley India Edn., 2007.
3. Steven C. Chapra and Ra P. Canale, Numerical Methods for Engineers with Programming and Software Applications, 7th Edition, Tata McGraw Hill, 2014.
4. R.L. Burden and J. D. Faires, Numerical Analysis, 4th Edition, Brooks Cole, 2012.

Mode of Evaluation: Digital Assignments, Continuous Assessment Tests, Final Assessment Test

Recommended by Board of Studies	25-02-2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

MEE1001	ENGINEERING DRAWING	L	T	P	J	C
		1	0	4	0	3
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives:

1. Understand and escalate the importance of basic concepts and principles of Engineering Drawing (components, sections, views, and graphical representation).
2. Enable the students with various concepts like dimensioning, conventions and standards related to working drawings in order to become professionally efficient.
3. Develop the ability to communicate with others through the language of technical drawing and sketching.
4. Ability to read and interpret engineering drawings created by others.
5. Ability to draw orthographic projections and sections.
6. Develop an understanding for size specification procedures and use of SI and traditional units of linear measure.

Expected Course Outcome:

Upon successful completion of the course the students will be able to

1. Apply BIS and ISO Standards in Engineering Drafting.
2. Graphically construct mathematical curves in engineering applications.
3. Visualize geometrical solids in 3D space through Orthographic Projections
4. Construct isometric scale, isometric projections and views.
5. Draw sections of solids including cylinders, cones, prisms and pyramids.
6. Draw projections of lines, planes, solids, isometric projections and sections of solids including cylinders, cones, prisms and pyramids using Mini-Dafter and CAD.
7. Construct orthographic projections from pictorial views.

Module: 1	Lettering and Dimensioning	1 hour
Introduction, lettering practice, Elements of dimensioning - systems of dimensioning.		
Module: 2	**Geometric Constructions**	**2 hours**
Free hand sketching, Conic sections, Special curves.		
Module: 3	**Projection of Points and Projection of Lines**	**3 hours**
Projection of Points: First and Third Angle Projections; Projection of points. **Projection of Lines:** Projection of straight lines (First angle projection only); Projection of lines inclined to one plane and both planes, true length and true inclinations.		
Module: 4	**Projection of Solids and Section of Solids**	**3 hours**
Projection of solids: Classification of solids, Projection of solids in simple position, Projection of solids inclined to one plane. **Sections of Solids:** Right regular solids and auxiliary views for the true shape of the sections.		
Module: 5	**Development of Surfaces**	**2 hours**
Development of surfaces for various regular solids.		
Module: 6	**Isometric Projection and Perspective Projection**	**2 hours**
Isometric Projection: Isometric scales, Isometric projections of simple and combination of solids;		

Perspective Projection: Orthographic representation of a perspective views – Plane figures and simple solids - Visual ray method.		
Module: 7	**Orthographic Projection**	**1 hour**
Conversion of pictorial view into orthographic Projection.		
Module: 8	**Contemporary issues**	**1 hour**
Total Lecture hours		**15 hours**

Text Book(s)

1. Venugopal K and Prabhu Raja V, "Engineering Graphics", New AGE International Publishers, 2015.

Reference Books

1. N. D. Bhatt, Engineering Drawing, Charotar publishing House, 2012.
2. Natarajan, K. V., A Text book of Engineering Graphics, Dhanalakshmi Publishers, 2012.

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

List of Challenging Experiments (Indicative) to be done using both Manual and CAD tools.

1.	Identifying the incorrect dimensioning and correct it as per BIS standards for Engineering Components.	4 hours
2.	Tutorials on free hand sketching of the plan view of stadium, garden, etc.,	4 hours
3.	Tutorials on geometric constructions like conics and special curves for projection of cricket ball, missile projection, etc.,	4 hours
4.	Representation of orthographic projection of points	4 hours
5.	Representation of orthographic projection of lines (First angle projection only) inclined to one plane and projection of lines inclined to both the planes- solving problems like electrical bulbs hanging from the roof, finding the shortest distance between fan to electrical switch board, etc.,	12 hours
6.	Sketching orthographic projection of solids in simple position and projection of solids inclined to one plane for household accessories and objects.	8 hours
7.	Drawing the auxiliary views, orthographic views and true shape of sectioned regular solids for household accessories and objects.	4 hours
8.	Development of lateral surfaces of the regular shapes and sectioned shapes for water cans, refrigerator, cylinder container, funnel, etc.,	4 hours
9.	Conversion of orthographic views to isometric views for engineering components.	8 hours
10.	Tutorial problems on perspective projection of plane figures and simple solids for train with track, landscape, etc.,	4 hours
11.	Conversion of pictorial drawing into orthographic projection for engineering components, architectural structures, etc.,	4 hours
Total Laboratory Hours		**60 hours**

Recommended by Board of Studies	17-08-2017		
Approved by Academic Council	47th ACM	**Date**	05-10-2017

MEE1002	ENGINEERING MECHANICS	L	T	P	J	C
		2	2	0	0	3
Pre-requisite	Nil	Syllabus version				
		1.1				

Course Objectives:

1. To enable students to apply fundamental laws and basic concepts of rigid body mechanics to solve problems of bodies under rest or in motion.
2. To enable the students to apply conditions of static equilibrium to analyse physical systems.
3. To compute the properties of areas and bodies.

Expected Course Outcome:

Upon successful completion of the course the students will be able to

1. Compute the resultant of system of forces in plane and space acting on bodies.
2. Predict the support-reactions and the internal forces of the members of various trusses and frames.
3. Analyse equilibrium problems with friction.
4. Apply transfer theorems to determine properties of various sections.
5. Analyse equilibrium of connected bodies virtual work method.
6. Predict motion parameters of bodies under rectilinear, curvilinear and general plane motion.

Module: 1	Basics of Statics	5 hours

Fundamental Principles - Coplanar forces - Resolution and Composition of forces and equilibrium of particles - Forces of a particle in space - Equivalent system of forces - Principle of transmissibility - Single equivalent force - Free body diagram - Equilibrium of rigid bodies in two dimensions and three dimensions

Module: 2	Analysis of Structures	4 hours

Types of supports and their reactions - Plane trusses and frames - Analysis of forces by method of joints and method of sections

Module: 3	Friction	3 hours

Characteristics of dry friction – simple contact friction – Wedges and Ladder friction

Module: 4	Properties of Surfaces and Solids	4 hours

Centroid - First moment of area – Second moment of area – Moment and product of inertia of plane areas – Transfer Theorems - Polar moment of inertia – Principal axes – Mass moment of inertia

Module: 5	Virtual Work	4 hours

Virtual work – Principle of virtual work – System of connected rigid bodies – Degrees of freedom – Conservative forces – Potential energy – Potential energy criteria for equilibrium.

Module: 6	Kinematics	4 hours

Displacements, Velocity and Acceleration – Rectilinear motion – Curvilinear motion – Tangential and Normal components – Radial and Transverse components.

Module: 7	Energy and Momentum Methods	4 hours

Principle of work and energy for a particle and a rigid body in plane motion – Conservation of energy - Principle of impulse and momentum for a particle and a rigid bodies in plane motion – Conservation of momentum.

Module: 8	**Contemporary issues**	**2 hours**
	Total Lecture hours	**30 hours**

Text Book(s)

1. Beer, Johnston, Cornwell and Sanghi (2013) Vector Mechanics for Engineers: Statics and Dynamics, 10th Edition, McGraw-Companies, Inc., New York.

Reference Books

1. Russell C Hibbeler and Ashok Gupta (2010), Engineering Mechanics: Statics and Dynamics (11th Edition), Published by Pearson Education Inc., Prentice Hall.
2. Meriam J.L and Kraige L.G. (2012) Engineering Mechanics, Volume I - Statics, Volume II - Dynamics, 7th Edition, John Wiley & Sons, New York.
3. Rajasekaran S and Sankara subramanian G (2013), Fundamentals of Engineering Mechanics, 3rd Edition, Vikas Publishing House Pvt. Ltd., India.

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

Recommended by Board of Studies	17.08.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

MEE1004	FLUID MECHANICS	L	T	P	J	C
		2	2	2	0	4
Pre-requisite	**NIL**	**Syllabus version**				
		1.1				

Course Objectives:

1. To apply hydrostatic law, principle of mass and momentum in fluid flows, concepts in Euler's and Bernoulli equations.
2. To provide fundamental knowledge of fluids, its properties and behaviour under various conditions of internal and external flows.
3. To determine the losses in a flow system, flow through pipes, boundary layer concepts.

Expected Course Outcome:

Upon successful completion of the course the students will be able to

1. Analyse various hydraulic systems by applying the fundamental laws of fluid statics.
2. Solve the fluid flow governing equations by taking suitable constraints and assumptions
3. Evaluate major and minor losses in pipes
4. Analyse the practical significance of open channel flows
5. Perform dimensional analysis on any real life problems
6. Interpret the boundary layer aspects of laminar and turbulent flows
7. Experimentally determine the fluid properties and flow parameters using various experimental setups.

Module: 1	**Introduction to Fluid Statics**	**4 hours**

Definition of fluid, Concept of continuum, Fluid properties, Classification of fluids, Pascal's and Hydrostatic Law, Pressure and its variation in a static Fluid, Measurement of static fluid pressure: Manometers

Module: 2	**Hydrostatic Forces and Buoyancy**	**4 hours**

Hydrostatic forces on Plane –Inclined and Curved surfaces, Buoyancy, Condition of Equilibrium for Submerged and Floating Bodies, Centre of Buoyancy, Metacentre–Determination of Metacentric Height.

Module: 3	**Fluid Kinematics and Dynamics**	**6 hours**

Fluid kinematics: Description of fluid motion – Lagrangian and Eulerian approach, Types of flows, Control volume, Material derivative and acceleration, Streamlines, pathlines and streaklines, Stream function and velocity potential function, Reynolds transport theorem

Fluid dynamics: Continuity equation, Euler and Bernoulli's equations – orifice meter, venturimeter, Momentum equation, Application of momentum equation – forces on curved pipes, Navier–Stokes Equations.

Module: 4	**Flow through pipes**	**4 hours**

Measurement in pipe flow-Major loss, Darcy–Weisbach equation, Moody's diagram, Minor losses, Multi reservoir problems, pipe network design, Hagen Poiseuille equation, Turbulent flow.

Module: 5	**Open channel flow**	**3 hours**

Types of open channel flows, Specific Energy, Specific force, Critical flow, Hydraulic jumps/Surges and gradually varying flow concepts, Measurement of discharge in open channels.

Module: 6	Dimensional Analysis	3 hours
Dimensional homogeneity, Raleigh's method, Buckingham π theorem, Non-dimensional numbers, Model laws and distorted models, Modelling and similitude		
Module: 7	**Boundary layer flow**	**4 hours**
Boundary layers, Laminar flow and turbulent flow, Boundary layer thickness, Momentum integral equation, Drag and lift, Separation of boundary layer, Methods of preventing the boundary layer separation		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**

Tutorials — **30 hours**

- Minimum of 10 problems to be worked out by students in every 2 hours of tutorial Class per week
- Another 5 problems per tutorial class to be given as home work.
- The topics in each module will be given as follows

Module 1: 4 hrs
Module 2: 4 hrs
Module 3: 6 hrs
Module 4: 4 hrs
Module 5: 4 hrs
Module 6: 4 hrs
Module 7: 4 hrs

Text Book(s)

1. Robert W. Fox, Alan T. McDonald, Philip J. Pirtchard John W. Mitchell (2015), Introduction to Fluid Mechanics, 9th Edition, Wiley Publications.

Reference Books

1. P. N. Modi and S. M. Seth (2011), Hydraulics and Fluid Mechanics including Hydraulic Machines, 17th Edition.
2. Yunus A. Çengel, John M. Cimbala (2013) Fluid Mechanics: Fundamentals And Applications, McGraw-Hill, 3rd Edition.
3. Dr. R. K. Bansal, (2012), A Textbook of Fluid Mechanics and Hydraulic Machines, 5th Edition, Laxmi Publication.
4. Donald F. Elger, Barbara C. Williams, Clayton T. Crowe, John A. Roberson (2013) Engineering Fluid Mechanics, John Wiley & Sons, 10th Edition.
5. V. L. Streeter, (2010), Fluid Mechanics, McGraw Hill Book Co.

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

List of Challenging Experiments (Indicative)

1.	Estimation of discharge from a given tank using orifice (constant head method)	3 hours
2.	Estimation of discharge from a given tank using mouthpiece (variable head method)	3 hours
3.	Determination of discharge in an open channel using rectangular Notch	3 hours
4.	Determination of discharge of a given pipe flow using venturimeter	3 hours
5.	Determination of discharge of a given pipe flow using orifice meter	3 hours
6.	Estimation of friction factor and major loss for a given flow system	3 hours

7.	Estimation of minor losses for a given pipe line	3 hours
8.	Determination of state of flow in a closed conduit using Reynold's experiment	3 hours
9.	Verification of conservation of energy principle for a given flow system using Bernoulli's Theorem	3 hours
10.	Estimating the flow rate in a pipe line using water meter	1.5 hours
11	Study and calibration of a pitot static tube	1.5 hours
Total laboratory hours		**30 hours**

Mode of assessment: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	17.08.2017		
Approved by Academic Council	47th ACM	Date	05.10.2017

CLE1010	NATURAL DISASTER MITIGATION AND MANAGEMENT	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	NIL	Syllabus version				
		1.0				

Course Objectives:

1. To understand the types of natural disasters and its causes.
2. To provide adequate knowledge about disaster mitigation, preparedness, response and recovery to face disaster among government bodies, institutions, NGO's, etc
3. To study the principle of natural disasters and geological natural disaster.
4. To obtain the knowledge of disaster management in mountainous regions and its early warning systems.
5. To develop skills in Mitigation and Preparation of Meteorological and Climatological natural disaster.
6. To provide adequate knowledge about applications of space technology in disaster monitoring and information dissemination.
7. To know the community based disaster management.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the types of natural disasters and its causes.
2. Understand the measures to be taken before a disaster strikes.
3. Understand the principle of natural disasters.
4. Develop skills in disaster management in mountainous regions and reduce damages from future disasters.
5. Examine the mitigation and preparation of meteorological and climatologically natural disaster.
6. Understand the applications of space technology in disaster monitoring and information dissemination.
7. Learn about the community based disaster management.

Module: 1	Introduction	6 hours

Natural Disasters around the world- Natural Disaster Risk Assessment- Earth and its characteristics – Environmental Change and Degradation - Climate Change - Global warming – Human Dimensions of Global environment Change

Module: 2	Disaster Preparedness	7 hours

Disaster mitigation, preparedness, response and recovery- comprehensive emergency management Early warning systems and Disaster Preparedness– Rehabilitation, Vulnerable Populations - Logistics and Services, Food, Nutrition and Shelter -Role of UN Red cross and NGOs.

Module: 3	Principles	5 hours

Natural Disasters -Principles, Elements, and Systems - Geological- Geomorphological, aspects, - Earthquake-Geology, Seismology, Characteristics and dimensions

Module: 4	Landslides	3 hours

Human impact on the mountainous terrain and its relationship with Rainfall, liquefaction etc- Tsunami - Nature and characteristics - Monitoring landslides- Landslide Early warning System

Module: 5	Oceanic, Atmospheric and Hydrologic cycles	6 hours
Severe Weather & Tornadoes , Cyclones, Floods and Droughts - Global Patterns - - Mitigation & Preparation – Drought – Famine- nature and dimensions – Drought Assessmentand Monitoring.		
Module: 6	**Mapping**	**8 hours**
Modelling, risk analysis and loss estimation – Natural disaster risk analysis - prevention and mitigation - Applications of Space Technology (Satellite Communications, GPS, GIS and Remote Sensing and Information /Communication Technologies (ICT) in Early warning Systems - Disaster Monitoring and Support Centre– Information Dissemination – Mobile Communications etc.		
Module: 7	**Community and Social organizations**	**7 hours**
Community based disaster management - Psychological effects after disasters - Socio Psycho care-managing Stress - Education and Training – Establishment of capacity building among various stake holders – Government - Educational institutions – Use of Multi-media knowledge products for self education.		
Module: 8	**Contemporary issues**	**3 hours**
Total Lecture hours		**45 hours**

Text Book (s)

1. Ghanshyam Singh and Sandip Bhandari, Disaster Management, Gullybaba Publishing House (P) Ltd; 1 edition (2012), ISBN-13: 978-9381066492

Reference Books

1. Bhandari, R.K, Disaster Education and Management, A Joyride for Students, Teachers and Disaster Managers, ISBN, 978-81-322-1565-3, XXVIII, 349, Springer India, 2014
2. Brian Tomaszewski, Geographic Information Systems (GIS) for Disaster Management, December 19, 2014 by CRC Press, Textbook - 310 Pages - 148 B/W Illustrations, ISBN 9781482211689 - CAT# K21688
3. Harsh K. Gupta, Disaster Management, Indian National Science Academy, ISBN 8173714568, 788173714566, 2006 second Edition, 152 Pages

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE1011	ENGINEERING GEOLOGY	L	T	P	J	C
		2	0	0	4	3
Pre-requisite	**CLE1003 Surveying**	**Syllabus version**				
		2.0				

Course Objectives:

1. To demonstrate the importance of Geology to take Civil Engineering decisions to solve the earth related problems.
2. To introduce the fundamental of the engineering properties of earth materials for the use of Civil Engineering constructions.
3. To develop quantitative skills and a frame work for solving Engineering Geological problems.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Know about the various internal structures of earth and plate tectonic movements.
2. Characterize the engineering properties of rocks, minerals and soil.
3. Assess the natural occurring various geological hazards.
4. Use seismic and electrical methods to investigate the subsurface of the earth.
5. Develop a native construction plan to incorporate all relevant aspects of Geology in Civil Engineering work.
6. Apply Remote Sensing and GIS knowledge to investigate the Geological structures

Module: 1	**Earth Structure**	**4 hours**

Relevance and importance of Engineering Geology of Civil Engineers, Internal structure of the earth- Composition - Plate Tectonics

Module: 2	**Minerals and Rocks**	**4 hours**

Minerals, their physical properties - rock forming minerals, physical and engineering properties of igneous, metamorphic and sedimentary rocks

Module: 3	**Weathering and Soil Formation**	**3 hours**

Rock decay and weathering, soil origin and formation – classification and its engineering importance, slope stability

Module: 4	**Geological Structures**	**4 hours**

Geological Structures - Folds, Faults and Joints – Engineering Considerations involves Structures.

Module: 5	**Geological Hazards**	**6 hours**

Brief description on geological hazards -cause and formation of flood, cyclone, Volcano, Landslides and earthquake – Remedial Measures. Geological Considerations for Dam Reservoirs, Tunnels and Road construction

Module: 6	**Ground Water**	**4 hours**

Characteristic of ground water, hydrogeological cycle, types of aquifers, water level fluctuations, surface and subsurface geophysical methods, groundwater contamination, harvesting of rainwater.

Module: 7	**Remote Sensing and GIS**	**3 hours**
Introduction to Remote sensing and Geographical Information System		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**
J-component		**60 hours**
Challenging Projects for an individual or a group will be given based on the basic and the advancements in the course contents.		
Text Book (s)		
1. Parbin Singh, Engineering & General Geology, S. K. Kataria and Sons- Delhi, 8th Edition, (2010).		
Reference Books		
1. Garg, S. K., Physical and Engineering Geology, Khanna Publishers, New Delhi, (2010). 2. Dimitri, P. Krynine and William, P. Judd, Principles of Engineering Geology and Geomechanics, CBS Publishers and Distributors, New Delhi, (2005). 3. Garg. S.K. (2004), Physical and Engineering Geology, Khanna Publishers. – Delhi 4. Blyth – Edward Arnold F.G.H (1998), A Geology for Engineers, (7th Edition) 5. H. H. Reed and F. Rutly (1960), Elements of Mineralogy, Thomas Murby, London. 6. M. P. Billings (1972), Structural Geology, Prentice Hall, Eaglewood Cliffs 7. David. K. Todd John Wily & Sons Inc, Ground Water Hydrology (2005), 3rd Edition, New York		
Project Titles (J component)		
Challenging projects for Individual or a group will be given based on the basic and advancements in the course content		
Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test		

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE1013	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	CHY1002 **Environmental Science**	Syllabus version				
		1.1				

Course Objectives:

1. To understand the basic concepts of EIA and its origin and also emphasis the role of engineers in EIA
2. To know the legislations to be used for enforcement of environmental acts for good EIA practices
3. To discuss the methods to be used in EIA
4. To know the impacts occurred to physical environment by the projects
5. To know the impacts occurred to biological environment by the projects
6. To know the impacts occurred to human resources by the projects
7. To draft a EIA for specific projects and understanding the mitigation and monitoring methods
8. To get exposed to practical experience for drafting a EIA through consultant / Government

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the importance of EIA for the project execution
2. Understand the role of government in approving the projects and the laws to be enforced
3. Examine suitable methods in handling the data collected during the EIA processes
4. Assess the impacts that could occur for human resources by the project
5. Assess the impacts that could occur for physical environment by the project
6. Assess the impact that could occur for biological environment by the project
7. Mitigate, monitor and draft an EIA report
8. Differentiate theoretical concepts and practical applications of an EIA report

Module: 1	**Environmental Impact Assessment (EIA)**	**7 hours**

Introduction, Definitions and Concepts, Rationale and Historical Development of EIA–EIA for Civil and Environmental Engineers–Environmental Impact Statement–Environmental Appraisal–Environmental Impact Factors.

Module: 2	**EIA Legislation**	**6 hours**

Criteria and Standards for Assessing Significant Impact–Risk Assessment–Enforcements of Environmental Acts, Rules and Regulations–Public Participation and Involvement.

Module: 3	**EIA Methodology**	**9 hours**

Defining Objectives of the Project–Consideration of Alternatives–Criteria for the Selection of EIA Methodology–EIA Methods–Screening–Scoping–Predictive Models for Impact Assessment–Mitigation, Monitoring, Auditing, Evaluation of Alternatives and Decision Making

Module: 4	**Prediction and Assessment of Impacts on Physical Environment**	**6 hours**

Geology –Soils – Minerals – Climate – Water Resources – Water Quality – Air Quality – Noise.

Module: 5	**Prediction and Assessment of Impacts on Biological Environment**	**5 hours**

Terrestrial Ecosystems – Wetland Ecosystems – Aquatic Ecosystems – Threatened and Endangered Species.

Module: 6	**Prediction and Assessment of Impacts on Human Resources**	**5 hours**
Demographics – Economics – Land Use – Infrastructure – Archaeological and Historic – Visual – Safety.		
Module: 7	**Impact mitigation and monitoring**	**5 hours**
Mitigation and monitoring process of adverse impacts, Rehabilitation and public participation, Drafting of EIS, Post monitoring and management (ISO 14000 series)		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**45 hours**

Text Book (s)

1. Environmental Impact Assessment, Larry W. Canter, 1st Edition, McGraw-Hill, Inc., 1996 (ISBN: 0-07-009767-4).
2. 'Handbook of Environmental Impact Assessment- Volume 1 & 2' authored by Judith Petts, Blackwell Science Ltd., 1999 (ISBN 0-632-04772-0; ISBN 0-632-04771-2).

Reference Books

1. 'Environmental Impact Assessment: Practical Solutions to Recurrent Problems' Edited by David P. Lawrence, John Wiley & Sons, Inc., (2013).
2. 'Environmental Impact Assessment: A Guide to Best Professional Practices' Edited by Charles H. Eccleston, CRC Press, 2011 (ISBN: 978-1-4398-2873-1).
3. 'Methods of Environmental Impact Assessment' Edited by Peter Morris and Riki Therivel, 3rd Edition, Routledge-Taylor & Francis Group, 2009 (ISBN: 0-203-89290-9).

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE1016	URBAN PLANNING	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	NIL	Syllabus version				
		1.1				

Course Objectives:

1. To introduce the history of town planning and its importance
2. To study the various steps involved in urban planning and to know the housing development schemes
3. To learn the planning and management of different infrastructure facilities in a city
4. To understand the importance of public transport and non-motorized transport for a sustainable city development
5. To know the importance of protecting the environment and natural resources in a city
6. To introduce the concept of smart cities in India

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Describe the importance of proper urban planning for a healthy city
2. Explain the steps involved in planning of a city using remote sensing and GIS
3. Describe housing development schemes
4. Plan and manage different infrastructure facilities in a city
5. Design public transport and non-motorized transport facilities for a city
6. Describe the importance of environment and natural resources in urban planning
7. Describe smart city developments in India and abroad and its various elements

Module: 1	Introduction	5 hours

History of Town Planning - Definitions and Objectives of Planning - Examples of planned and unplanned cities - Retrofitting medieval towns and existing cities - Healthy city planning.

Module: 2	Basic Planning Methods	6 hours

Base map preparation - survey techniques - Analytical methods - region classification - Demographic methods - population forecasting. Introduction of Remote sensing, GIS and GPS in urban planning context - Regional planning

Module: 3	Housing Development	5 hours

Policies and schemes - Housing typologies - Housing for the poor and elderly - Housing finance options –under privileged population management.

Module: 4	Infrastructure	6 hours

Planning and management of local streets, water supply, storm water drainage, municipal solid waste management systems- New possibilities for recycling.

Module: 5	Transport And Mobility	7 hours

Costs of congestion - Public and Para-transit modes (taxis and autos) - Feeder systems for the use of public transport - Non-motorized transport facilities - cycling and walking infrastructure - Integrated public transport.

Module: 6	Environment And Public Health	5 hours

Environmental Quality - Sanitation - Physical and mental health challenges in urban and sub-urban areas - Vulnerable population - Conserving natural resources

Module: 7	Smart Cities	8 hours
Smart city developments across the world - Specific priorities for Smart Cities in India - Leveraging recent technologies in enhancing urban living: internet of things (IoT) - Recreation -Renewable energy - Green corridors, green space and green buildings - Safety and security of urban population.		
Module: 8	**Contemporary issues**	**3 hours**
Total Lecture hours		**45 hours**

Text Book (s)

1. Peter Hall, Mark Tewdwr-Jones, Urban and Regional Planning. Taylor & Francis, (2010).

Reference Books

1. Peter Hall, Cities of Tomorrow: An Intellectual History of Urban Planning and Design Since 1880. 4th Edition, Wiley-Blackwell, (2014).
2. Randall Crane and Rachel Weber, The Oxford Handbook of Urban Planning. Oxford University Press, (2012).
3. Ian Bracken, Urban Planning Methods: Research and Policy Analysis. Routledge, Taylor & Francis, (2009).
4. Harry T. Dimitriou, Ralph Gakenheimer, Urban Transport in the Developing World: A Handbook of Policy and Practice. Edward Elger, USA, (2011).
5. Joy Sen., Sustainable Urban Planning. The Energy and Resources Institute, New Delhi, India, (2013).
6. Russ Lopez., The Built Environment and Public Health. John Wiley & Sons, (2012).
7. Eddie N. Laboy-Nieves, Fred C. Schaffner, Ahmed Abdelhadi, Mattheus F.A. Goosen. Environmental Management, Sustainable Development and Human Health. CRC Press, Taylor & Francis, (2008).
8. Carol L. Stimmel, Building Smart Cities: Analytics, ICT, and Design Thinking. CRC Press, Taylor & Francis, (2015).
9. Durganand Balsavar, Mahindra World City, Public Private Partnerships in Urban Planning, Mapin Publishers, (2012).

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47rd ACM	**Date**	05.10.2017

CLE2007	ADVANCED CONCRETE TECHNOLOGY	L	T	P	J	C
		3	0	2	4	5
Pre-requisite	**CLE1007 – Construction Materials and Techniques**	**Syllabus version**				
		1.0				

Course Objectives:

1. To understand the classification of cement, its manufacturing process and testing standards of cement.
2. To know the various types of materials used to make concrete and their influence in concrete.
3. To study the proportioning of concrete mix for different grades of concrete.
4. To obtain the knowledge of non-destructive tests on concrete.
5. To know the various types of special concretes, their properties and places where they are used.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Identify the quality of cement by various testing methods as per standards.
2. Evaluate the workability of concrete in the field.
3. Compute the strength of hardened properties of concrete.
4. Evaluate the quality of concrete using NDT equipment
5. Design the required grade of concrete with the available materials and estimate the quantity of material required for casting.
6. Classify the various durability properties of concrete.
7. Identify the different types of special concrete that can be used in structural application.

Module: 1	**Concrete Ingredients**	**6 hours**

ASTM classification of Cement - Manufacturing - Types of cement - Properties of Cement - Testing of Cement - Fine aggregates and coarse aggregates- Properties and testing-process of hydration

Module: 2	**Properties of Concrete**	**6 hours**

Selection of materials for concrete - water cement ratio - Properties of fresh concrete - workability - measurement of workability - Admixtures - process of various stages of concrete - Statistical and quality control of concrete.

Module: 3	**Mechanical properties of concrete**	**6 hours**

Strength of concrete - gain of strength with age - testing of hardened concrete - Compressive strength -Tensile strength - Flexural strength - modulus of elasticity of concrete - Stress and Strain characteristics.

Module: 4	**Non-destructive techniques**	**6 hours**

Rebound hammer and ultrasonic Pulse Velocity test - Corrosion rebar test.

Module: 5	**Mix Design**	**6 hours**

Concrete mix design - concepts of mix design - variables in proportioning - Different methods of mix design - Indian Standard method IS 10262.

Module: 6	**Durability of concrete**	**6 hours**

Permeability of concrete - Shrinkage-plastic shrinkage - drying shrinkage - Chemical attack -

Sulphate attack of concrete structures - chloride attack.		
Module: 7	**Special Concretes**	**6 hours**
High performance concrete - high strength concrete, high density concrete - light weight concrete - Fibre reinforced concrete - self-compacting concrete - Polymer concrete.		
Module: 8	**Contemporary issues**	**3 hours**
Total Lecture hours		**45 hours**

Text Book (s)

1. Gambir M. L, Concrete Technology, Tata MC-Graw Hill-Education, 2013.
2. Shetty M. S., Concrete Technology, S. Chand & Company Ltd., 2010
3. Metha P. K, "Concrete: Microstructure, properties and Materials", McGraw-Hill, 2014.

Reference Books

1. Zongjin Li, Advanced Concrete Technology, John Wiley & Sons – 2011
2. IS: 12269-1987, Specification for 53 grade ordinary Portland Cement, BIS, New Delhi.
3. IS: 383 – 1970, Specification for Coarse and fine natural sources for Concrete, BIS, New Delhi.
4. IS: 10262-2009, Concrete Mix Proportioning - Guidelines.

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Laboratory Exercises

Tests on various properties of the ingredients of concrete: Cement	4 hours
Tests on various properties of the ingredients of concrete: Fine aggregate	4 hours
Tests on various properties of the ingredients of concrete: Coarse aggregate	4 hours
Workability tests on concrete: Slump Cone test, Compaction factor test and Consistency test (VB Consistometer)	4 hours
Mechanical properties of concrete: Casting of concrete cube, cylinder specimens, curing and testing.	4 hours
Study on the fresh state properties of the special concrete: Self-Compacting concrete	4 hours
Tests for assessing the performance of hardened concrete finding its Stress-strain relationship, Young's Modulus.	3 hours
Non-destructive Testing: Existing Beam, column & slabs	3 hours
Total	**30 hours**

Sample project titles for J – Component

Sl. No.	Project Titles	L Hrs
1.	Experimental study on mechanical properties of Steel fiber concrete	**60 hrs.**
2.	Comparative study on natural and synthetic fiber concrete	
3.	Experimental study on flexural behavior of light weight concrete	
4.	Rheological properties of Self compacting concrete	
5.	Flexural behavior of geo-polymer concrete	
6.	Durability study on geo-polymer concrete	

7.	Durability studies on bottom ash concrete	
8.	Creep and shrinkage studies on natural fiber concrete	
9.	Creep and shrinkage studies on synthetic fiber concrete	
10.	Durability studies on recycled aggregate concrete	
11.	Durability studies on self-compacting concrete	
12.	Study the influence of chemical and mineral admixture on mechanical properties of concrete	

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE2008	CONSTRUCTION PLANNING AND MANAGEMENT	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	CLE1007 – Construction Materials and Techniques	Syllabus version				
		1.1				

Course Objectives:

1. To understand the principles of management and construction safety measures
2. To know the role of project manager and the Labour Welfare measures.
3. To write case studies of International projects and adapt project management practices to meet the needs of stakeholders
4. To understand the procedures in accounts and stores during construction activities
5. To identify the rules involved in constructing network diagram of a project.
6. To analyse the network in a construction project using CPM and PERT Method

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Explain the principles of management and construction safety measures
2. Discuss the behavioral aspects of projects in terms of project manager and choose the Labour Welfare measures
3. Explain the case studies of International projects and select project management practices to meet the needs of stakeholders
4. Know the procedures adopted in accounts and stores during construction activities
5. Construct network diagram for activities involved in the construction project.
6. Compute critical path and floats for a given network diagram using CPM Method
7. Analyze the uncertainties in the project network using PERT method

Module: 1	Principles of Management	5 hours

Definition - Importance – Functions of Management - Relevance to government and Quasi Government departments - Private Contractors - Contracting firms - Organizational structure. Construction safety measures.

Module: 2	Construction Planning and Labour Welfare	8 hours

Collection of field data - Preliminary estimates - Approval and sanction of estimates - Budget provisions - Relationships between management and labour - Problems - Labour legislations - Minimum Wages act - Industrial Psychology - Safety procedures in construction.

Module: 3	Projects	7 hours

Tendering - Arbitration - International projects - Detailed Project Reports (DPR) / Build Own Operate (BOO) / Build Own Operate Transfer (BOOT) Projects / Build Operate and Transfer (BOT) - case studies.

Module: 4	Accounts and Stores	6 hours

Measurements of work - Checking - Types of bills - Mode of payment - Claims - Banking settlements - Types of accounts - Cash book - Storing - Maintenance Inspection - Inventories - Transfer of surplus and accounting of shortage stores - Procedures adopted in PWD and CPWD.

Module: 5	Network element and development of Network	7 hours

Introduction - Event - Activity - Dummy - Network rules - Graphical guidelines for network -

Common partial situations in network - Numbering the events - Cycles Problems - Planning for network construction - Modes of network construction - Work breakdown structure Hierarchies.		
Module: 6	**CPM**	**5 hours**
Introduction - Slack - Critical Path - Example problem - Activity time estimate - Earliest event time - Latest allowable occurrence time - Combined tabular computations for TE and TL - Start and finish time of activity - Float - Critical activity and Critical path - Problems.		
Module: 7	**PERT**	**5 hours**
Introduction - Use of PERT - Time estimate - Frequency distribution - Mean, Variance and standard deviation - Probability distribution - Expected time problem - Example problems.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**45 hours**

Text Book (s)

1. Chitkara, K. K "Construction Project Management Plan, Se (English) 2nd Edition, Tata Mcgraw Hill Education Private Limited, 2010.
2. Sharma, J. L, "Construction Management and accounts" Satya Publications, 2013.

Reference Books

1. Prasad, L. M "Principles of Management", Sultan Chand & sons, New Delhi, 2012.
2. Stephen Robbins, "Organizational Behavior", Pearson Education, New Delhi, 2011.

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE2009	ADVANCED SOIL MECHANICS	L	T	P	J	C
		2	2	0	0	3
Pre-requisite	CLE1004 – Soil Mechanics & Foundation Engineering	Syllabus version				
		1.1				

Course Objectives:

1. To understand the soil composition and structure
2. To learn the stress-strain relationship
3. To know about the slope stability and its analysis

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Identify the mineral and structure of clay
2. Evaluate effective stress in soil due to seepage
3. Determine consolidation settlement of structures built on clayey deposits
4. Evaluate the factors influencing stress path
5. Estimate factor of safety of a slope
6. Identify suitable scaling law for physical modelling

Module: 1	Soil Composition And Soil Structure	5 hours

Soil formation; Types of soils and their characteristics; Particle sizes and shapes; their impact on engineering properties;
Soil structure; Clay mineralogy; Different types of bonding in clay minerals, Soil-air-water interaction.

Module: 2	Seepage and Flow Nets	3 hours

Permeability; Seepage force and effective stress during seepage.
Laplace equations of fluid flow, Flow nets, Anisotropic and non-homogeneous medium, Confined and Unconfined seepage.

Module: 3	Compressibility and Consolidation	3 hours

Stresses in soil from surface loads; Terzaghi's 1-D consolidation theory; Application in different boundary conditions. Normally and Over consolidated soils; Compression curves; Secondary consolidation. Radial consolidation; Settlement of compressible soil layers and Methods for accelerating consolidation settlements.

Module: 4	Stress-Strain Relationship	3 hours

Stress state, Mohr's circle analysis and Pole, Principal stress space, Stress paths in p-q space; Isotropic compression and pressure dependency, confined compression, large stress compression, Drainage conditions.

Module: 5	Shear Strength of Soils	4 hours

Triaxial behaviour, stress state and analysis of UC, UU, CU, CD, and other special tests, Skempton pore pressure parameters.

Module: 6	Stability of Slopes	4 hours

Stability analysis of infinite slopes; Finite slopes – Swedish circle method, Friction circle method and Taylors stability chart; Methods for enhancing stability of unstable slopes.

Module: 7	Geotechnical Physical Modeling	6 hours

Physical modeling methods; Application of centrifuge modeling and its relevance to geotechnical engineering; Centrifuge modeling of geotechnical structures.

Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30hours**
Tutorial • A minimum of 3 problems to be worked out by students in every tutorial class. • 5 problems to be given as homework per tutorial class. Tutorial Class for Module 1 Tutorial Class for Module 2 Tutorial Class for Module 3 Tutorial Class for Module 4 Tutorial Class for Module 5 Tutorial Class for Module 6 Tutorial Class for Module 7		**30 hours**

Text Book (s)

1. Das, B.M. Advanced Soil Mechanics. Taylor and Francis Group, London, Second edition, (2013).

Reference Books

1. Wood, D. W., Geotechnical Modelling Spon Press, Taylor and Francis Group, London, First edition, (2007).
2. Powrie, W., Soil Mechanics concepts and applications. Spon Press, Taylor and Francis Group, London, Second edition, (2009).

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE2010	GROUND IMPROVEMENT TECHNIQUES	L	T	P	J	C
		2	0	0	4	3
Pre-requisite	CLE1004 – Soil Mechanics & Foundation Engineering	Syllabus version				
		1.0				

Course Objectives:

1. To understand the properties of various types of problematic soils
2. To give an overview of latest ground improvement techniques
3. To understand the problems related to soil and select the best suitable method for improvement.
4. The concepts and the design principles involved in the various techniques

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Identify the problems in Expansive soils
2. Classify best suited stabilization method based on soil properties
3. Categorize the best suited technique based on the ground conditions
4. Design the various ground improvement techniques
5. Identify suitable dewatering technique based on groundwater table

Module: 1	**Introduction**	**3 hours**
Different types of problematic soils and their geological formation principles of treatment-loading.		
Module: 2	**Treatment of Loose Sands**	**5 hours**
Compaction piles, dynamic compaction, vibroflot technique, controlled blasting for compaction.		
Module: 3	**Grouting Techniques**	**4 hours**
Permeation grouting, Compaction technique, jet grouting, different varieties of grout materials, grouting in difficult conditions.		
Module: 4	**Treatment of Expansive Soils**	**4 hours**
Physical and chemical stabilization injection method, lime-columns.		
Module: 5	**Accelerated Consolidation Methods For Soft Clay Soils**	**4 hours**
Sand drains, Pre-fabricated drains, and Stone columns		
Module: 6	**Geosynthetics**	**3 hours**
Concepts -materials, Types and application of reinforced earth – Introduction to Geosynthetics - geo-textiles-separation and road work – Case studies		
Module: 7	**Dewatering Techniques**	**5 hours**
Introduction-Well points-Vaccum / electro osmatic methods		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**

Text Book (s)

Hausmann, H.R. "Engineering Principles of Ground Modification", McGraw-Hill Book Company. 3rd Edition 2010.

Reference Books

1. P. Purushotamaraj "Ground Improvement Techniques", Laxmi Publications (P) Ltd. 2016.
2. Gulati and Datta "Geotechnical Engineering", Tata McGraw Hill. 2017.

Sl. No.	Sample Projects for J component	hours
1.	Stabilization of soft clays using admixtures.	60 hours
2.	Stabilization of expansive soils using chemical stabilization.	
3.	Analysis and behavior of stone columns using PLAXIS.	
4.	Use of synthetic fibres in soil stabilization.	
5.	Use of natural fibers in soil stabilization.	
6.	Laboratory study on use of geosynthetics.	
7.	Consolidation studies using drains	
8.	Study on vacuum consolidation	
9.	Slope protection measures	
10.	Stability analysis of natural and man-made slopes	

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE2011	SOIL DYNAMICS AND MACHINE FOUNDATION	L	T	P	J	C
		2	2	0	0	3
Pre-requisite	CLE1004 – Soil Mechanics and Foundation Engineering	Syllabus version				
		1.1				

Course Objectives:

1. To understand the fundamentals of vibration
2. To learn the dynamic properties of soil
3. To analyze and design machine foundation
4. Understand the wave propagation and dynamic properties of soil
5. To understand soil modeling for cyclic loading

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Distinguish different types of vibrations and its response
2. Examine the wave propagation and dynamic properties of soil
3. Determine the dynamic properties of soil
4. Evaluate the soil modeling for cyclic loading
5. Understand the principle of vibration Isolation
6. Evaluate the stiffness and damping of shallow foundations
7. Analyze and design machine foundation

Module: 1	Fundamentals of Vibration	4 hours

Introduction, Sources of vibrations, Basics concepts of vibration, classification of vibrations, Vibration analysis procedure, Simple harmonic motion.Undamped free vibration of SDOF systems Damping: Linear, Non-linear damping, Equivalent viscous damping. Damped free vibration of SDOF systems. Response of damped SDOF system under harmonic force and rotating unbalanced force.

Module: 2	Wave Propagation in Elastic Medium	4 hours

Shear and Dilational waves, Rod waves – Natural frequencies and mode shapes, Rayleigh waves and their significance in soil dynamics, attenuation of shear waves.

Module: 3	Dynamic soil properties	3 hours

Dynamic soil properties - Gmax, Gsec, Gtan, G/Gmax and damping. Factors affecting dynamic soil properties.
Lab tests: Resonant column test, Bender element test, cyclic triaxial / simple shear / Torsional shear tests
Field tests: Seismic reflection and refraction tests, Seismic crosshole and downhole tests, SASW/MASW tests, Block vibration test, Cyclic Plate load test, SPT and DCPT.

Module: 4	Soil modeling for cyclic loading	6 hours

Linear viscoelastic model – stress-strain relationship – Kelvin model – Maxwell model. Nonlinear stress-strain model – Hyperbolic model, Masing model, Ramberg-Osgood model.

Module: 5	**Dynamic stiffness of shallow foundations**	**3 hours**
Circular rigid mat foundation on elastic half space excited vertically, laterally, torsion or rocking – Effective stiffness and damping of such systems. Effect of foundation shape and embedment on stiffness and damping constants Finite soil layer and depth to bedrock on system of rigid foundations		
Module: 6	**Vibration Isolation**	**3 hours**
Principles of vibration isolation – Active and Passive Isolation, Methods of isolation, Design of wave barriers.		
Module: 7	**Analysis and Design of Machine Foundations**	**5 hours**
Block foundations for reciprocating engines and low speed rotary machines, Block foundations for forge hammers and other impact machines, Frame foundations for high speed rotary machineries, Spring mounted foundations.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**
Tutorial • A minimum of 3 problems to be worked out by students in every tutorial class. • 5 problems to be given as homework per tutorial class. Tutorial Class for Module 1 Tutorial Class for Module 2 Tutorial Class for Module 3 Tutorial Class for Module 4 Tutorial Class for Module 5 Tutorial Class for Module 6 Tutorial Class for Module 7		**30 hours**

Text Book (s)	
1.	Das B.M and Ramanna G.V., Principles of soil dynamics 2nd Edition, Cengage learning, Stanford, USA, (2011).
Reference Books	
1.	K.G. Bhatia, Foundations For Industrial Machines, D-CAD Publishers, (2008).
2.	Kramer, S. L., Geotechnical Earthquake Engineering, Pearson Education Inc., New Delhi, (2010).
3.	Prakash, S. and Puri, V. K., Foundation for machines: Analysis and Design, John Wiley & Sons, New York, (2008).

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE2013	ADVANCED FOUNDATION ENGINEERING	L	T	P	J	C
		2	2	0	0	3
Pre-requisite	CLE1004 – Soil Mechanics and Foundation Engineering	Syllabus version				
		1.1				

Course Objectives:

1. To learn about advanced methods for soil exploration
2. To understand and design different types of foundations
3. To study the retaining walls and its design
4. To understand the concept of soil reinforcement and the design principles of reinforced earthen structures

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Identify the suitable method for soil exploration
2. Design suitable shallow foundation based on soil characteristics as per IS standards
3. Design of a deep foundation as per standards
4. Design of gravity and cantilever walls
5. Design of sheet pile wall.
6. Analyze and Design of reinforced earth retaining wall

Module: 1	Advanced soil exploration methods	4 hours

Introduction, Cone penetration test, Pressure meter test, Dilatometer test, Geophysical exploration methods.

Module: 2	Shallow Foundations	4 hours

Introduction, Bearing capacity - correction factors, Eccentrically loaded foundations, closely spaced foundations, bearing capacity of layered soils, combined footing.

Module: 3	Pile Foundation	5 hours

Methods of construction of bored cast-insitu pile, Pile installation, Laterally loaded piles and different types of load tests on piles. Application of stress-wave theory.

Module: 4	Mat Foundation	4 hours

Introduction, rigid and flexible mat, Bearing capacity, Differential settlement, buoyancy raft, structural design of mat foundations.

Module: 5	Well Foundations	4 hours

Types, components, construction methods, design methods (Terzaghi, IS and IRC approaches), check for stability, base pressure, side pressure and deflection.

Module: 6	Retaining Walls	3 hours

Design of gravity and cantilever walls, design of cantilever and anchored sheet pile walls. Support systems for flexible retaining walls – anchors, struts, construction methods, stability calculations. Construction of diaphragm walls, barrettes, caissons, soldier piles and lagging.

Module: 7	**Reinforced Earth**	**4 hours**
Geotechnical properties of reinforced soil, shallow foundation on soil with reinforcement, retaining walls with reinforcements, design considerations.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**
Tutorial • A minimum of 3 problems to be worked out by students in every tutorial class. • 5 problems to be given as homework per tutorial class. Tutorial Class for Module 1 Tutorial Class for Module 2 Tutorial Class for Module 3 Tutorial Class for Module 4 Tutorial Class for Module 5 Tutorial Class for Module 6 Tutorial Class for Module 7		**30 hours**

Text Book (s)

1. Swamisaran, Reinforced soil and its Engineering applications, I.K. International Pvt. Ltd., (2010).

Reference Books

1. Braja. M. Das. Principles of Foundation Engineering, 2011, Cengage Learning. 7th Edition, (2010).
2. J. E. Bowles, Foundation Analysis and Design, McGraw-Hill Book Company, 5th Edition (2013).
3. Purushothama Raj. Soil Mechanics & Foundation Engineering, darling Kindersley publishing, (2011).

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE2014	GEOTECHNICAL EARTHQUAKE ENGINEERING	L	T	P	J	C
		2	0	0	4	3
Pre-requisite	CLE1004 – Soil Mechanics and Foundation Engineering	Syllabus version				
		1.0				

Course Objectives:

1. To give an overview of ground motion
2. To understand the dynamic properties of soil and liquefaction phenomena

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Identify proper magnitude and intensity scales
2. Analyse the seismic hazard of a given site
3. Evaluate strong ground motion parameters
4. Estimate dynamic properties of soil such as shear wave velocity, shear modulus, coefficient of elastic uniform compression
5. Assess the response of the site for given seismic input motion
6. Evaluate factor of safety against liquefaction of a given site and decide on suitability of the site for construction
7. Identify suitable technique of ground improvement to mitigate seismic hazard

Module: 1	Introduction to Geotechnical Earthquake Engineering	3 hours

Seismic hazard Seismology and Earthquakes-Nature and types of earthquake loading-Wave Propagation

Module: 2	Strong Ground Motion	4 hours

Introduction-Strong ground motion-Ground motion parameters-Estimation of ground motion parameters-Spatial variability of ground motions

Module: 3	Seismic Hazard Analysis	4 hours

Introduction-Identification and Evaluation of Earthquake Sources-Deterministic Seismic Hazard Analysis-Probabilistic Seismic Hazard Analysis

Module: 4	Dynamic properties of soil	5 hours

Dynamic soil properties- Factors affecting dynamic soil properties.
Lab tests: Cyclic triaxial / simple shear / Torsional shear tests
Field tests: Block vibration test, Cyclic Plate load test.

Module: 5	Liquefaction related Phenomenon	4 hours

Types of Liquefaction-Evaluation of Liquefaction hazard-Liquefaction Susceptibility-Initiation of Liquefaction-Effects of Liquefaction

Module: 6	Site Response Analysis	4 hours

Ground Response Analysis - Linear, Equivalent linear and Non-linear approach- Site Classification

Module: 7	Soil Improvement	4 hours

Densification Technique-Reinforcement Techniques-Grouting Techniques-Drainage Techniques-Verification of soil improvement

Module: 8	**Contemporary issues**		**2 hours**
Total Lecture hours			**30 hours**
Text Book (s)			
1. Steven L. Kramer, "Geotechnical Earthquake Engineering", Prentice Hall, (2013)			
Reference Books			
1. B. N. Das and Ramana, "Principles of Soil Dynamics", Cangage Learning, 2nd edition (2011)			
Project Titles (J component)			**Hrs.**
Challenging projects for Individual or a group will be given based on the basic and advancements in the course content			**60 hrs**
Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test			
Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE2015	HYDRAULIC STRUCTURES AND MACHINERY	L	T	P	J	C
		2	2	2	0	4
Pre-requisite	MEE1004 – Fluid Mechanics	Syllabus version				
		1.1				

Course Objectives:

1. To understand the working principles of turbines
2. To know the various types of pumps and its applications
3. To study the various structures designed for storage work and for the development of irrigation system.
4. To obtain the knowledge of various modes of failure of hydraulic structure and its remedial measures
5. To know the various types of cross drainage work and its applications
6. To study various types of dams and their factors governing their selection
7. To determine performance of Vanes, Turbines and Pumps.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Classify the turbines and explain design criteria based on water availability
2. Discuss the characteristics of centrifugal pump and reciprocating pumps
3. Identify different component in an head work and its use
4. Design the head work of an irrigation system
5. Design the drops, escapes and outlet for the canal system
6. Describe various storage zones in an reservoir
7. Calculate different types of forces acting on a dam and design it.
8. Ability to formulate and conduct experiments, and also to analyze and interpret data

Module: 1	Impact of Jet on Vanes and Turbines	5 hours

Impact of Jet on flat and curved vanes, Classification - Pelton Turbine, Francis Turbine, Kaplan Turbine-Velocity Triangle, Characteristic Curves, Specific Speed -Governing of Turbines.

Module: 2	Strong Ground Motion	5 hours

Centrifugal Pump-Velocity triangle, characteristic curves, specific speed. Reciprocating pump – Types – Indicator diagram-Acceleration and friction, air vessels.

Module: 3	Diversion Head work	5 hours

Weir and Barrage – Gravity and Non –gravity weir- Layout of a diversion head works and its components – Under sluice –Divide wall- River training works- fish ladder

Module: 4	Theories of seepage and Design ofe weir	3 hours

Failure of hydraulic structure- Bligh's creep theory – Lane's weighted creep theory- Design of Vertical drop weir on Bligh's theory – Basic cutoff walls.

Module: 5	Regulators and Modules	3 hours

Canal regulation works –Distributary Head regulator and cross regulator- Types of canal escapes – Types of outlets (Modules)- cross drainage works

Module: 6	Reservoirs	2hours

Reservoir types- storage capacity, storage zones, Sedimentation- causes, effect & control measures.

Module: 7	**Dams and Hydro- electric power structures**	**5 hours**
Dams, factors governing their selection - Classification, Elementary design of gravity dam - spill ways, energy dissipators, spill way gates, Classification of hydel plants- Principal components of a hydro-electric scheme - water hammer - remedies		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**

Tutorial

- A minimum of 3 problems to be worked out by students in every tutorial class.
- 5 problems to be given as homework per tutorial class.

Tutorial Class for Module 1
Tutorial Class for Module 2
Tutorial Class for Module 3
Tutorial Class for Module 4
Tutorial Class for Module 5
Tutorial Class for Module 6
Tutorial Class for Module 7

30 hours

Text Book (s)

1. Bansal R.K, (2010) " Fluid mechanics & hydraulic machines" Lakshmi Publishers, New Delhi
2. Santosh Kumar Garg (2012) "Irrigation Engineering and Hydraulic Structures" Khanna Publisher

Reference Books

1. Das M.M Fluid Mechanics and Turbo machines, Prentice Hall of India (P) Ltd New Delhi, (2012).
2. Arore, K.R Fluid Mechanics, Hydraulic and Hydraulic Machines, Standard Publishers and Distributors, New Delhi, (2011).
3. PN Modi, "Irrigation water resources and water power engineering" standard book house 9thedition, (2011).
4. Dr J. F. Douglas , Dr J. M. Gasoriek, Prof John Swaffield, Lynne Jack, "Fluid Mechanics" Pearson Fifth edition, (2010).

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Laboratory

1. Statistical and error analysis of centrifugal pump	3 hours
2. Determine the flow ratio for jet impingement on vanes for different types of vanes	3 hours
3. Performance characteristics curve for pump in series and pump in parallel.	3 hours
4. Prediction of design head and design discharge of self-priming pump	3 hours
5. Determination slip of reciprocating pump	3 hours
6. Performance of main characteristics of a Gear Pump	3 hours
7. Performance operating characteristics of a Submersible pump	3 hours
8. To determine iso-efficiency curves for Pelton turbine	3 hours
9. Load test on Francis Turbine	3 hours
10. Characteristics load test on Kaplan Turbine	3 hours
Total	**30 hours**

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE2017	HYDROLOGY	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	MEE1004 – Fluid Mechanics	Syllabus version				
		1.1				

Course Objectives:

1. To understand the physical processes that determines the exchange of water at the Earth's surface.
2. To become familiar with the physical properties that govern the movement of water through the unsaturated zone and how these can be observed in the field and modeled mathematically.
3. To understand the physical factors that control evaporation and their representation using energy fluxes and diffusive transfer.
4. To be familiar with the various physical and empirical models used to calculate evaporation & evapotranspiration and the data need to support their use.
5. To be able to understand the processes which influence runoff from catchments and the methods for estimating the runoff
6. To use measured / estimated data like precipitation, runoff, infiltration, for hydrologic design

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the process and mathematical representation of hydrologic cycle
2. Differentiate the measure and apply precipitation for hydrologic design
3. Understand the importance of catchment characteristics for runoff estimation
4. Evaluate the hydrologic abstractions and also learn about the factors affecting various hydrologic abstractions
5. Comprehend unit hydrograph theory and its applications to hydrologic design
6. Apply statistical tools to hydrologic data
7. Implementing the knowledge of precipitation and runoff measurement in hydrologic design

Module: 1	Introduction	5 hours

Hydrologic cycle, hydrologic system model, Water budget: analysis and synthesis, atmospheric circulation.

Module: 2	Precipitation	8 hours

Formation of precipitation – types of precipitation – Precipitable water – Precipitation in a cloud system - Rainfall measurement and characteristics – Estimating missing rainfall data – Rain gauge consistency – Average annual rainfall – Development of a design storm – probable maximum precipitation

Module: 3	Watershed Characteristics	5 hours

Watershed definition and delineation - Watershed geomorphology – channel geomorphology – travel time estimation

Module: 4	Hydrologic Abstractions	6 hours

Infiltration: Definition and factors affecting infiltration – Infiltration Estimation: Horton's model, Green-Ampt Model, Infiltrometer, SCS Method. Evaporation and Transpiration: Definition, factors affecting evaporation, methods for estimation of evaporation – EPT: Definition, estimation of EPT

Module: 5	Unit Hydrograph	8 hours

Sources of streamflow, streamflow hydrograph and hydrograph characteristics, excess rainfall and

direct runoff, Abstractions: Using infiltration indices and SCS method – Peak discharge Unit hydrograph: Definition, Assumptions and Limitations, UH derivation and Application, S-Hydrograph, Synthetic UH, UH for different rainfall durations		
Module: 6	**Frequency Analysis**	**5 hours**
Return period, extreme value distributions, Frequency analysis using frequency factors, Probability plotting – Risk Assessment		
Module: 7	**Hydrologic Design**	**5 hours**
Design Storms: Design precipitation depth, IDF curves, Design precipitation hyetographs from IDF curves, Calculation of probable maximum precipitation. Design Flows: Simulating design flows, flood plain analysis, flood forecasting		
Module: 8	**Contemporary issues**	**3 hours**
Total Lecture hours		**45 hours**

Text Book (s)

1. VenTe Chow, David R Maidment, Larry W. Mays, Applied Hydrology. McGraw Hill International Editions, (2010)
2. Subramanya, Engineering Hydrology, Tata McGraw Hill Co., Graw Hill Co., (2010).

Reference Books

1. Hydrology and Water Resources Engineering, S.K. Garg, JBA publishers, (2015)

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE2018	INDUSTRIAL WASTES TREATMENT AND DISPOSAL	L	T	P	J	C
		2	0	0	4	3
Pre-requisite	CLE1006 – Environmental Engineering	Syllabus version				
		1.0				

Course Objectives:

1. To provide an understanding of the industrial wastes treatment and disposal methods
2. To know the sources of various industrial wastes and its treatment methods
3. To understand the design and operation of disposal of industrial wastes
4. To know the various processes of wastewater treatment and its engineering requirements
5. To provide adequate knowledge about pollution phenomena of various industries including gaseous pollutants.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Apply waste minimization concepts in managing the industrial wastes
2. Identify and justify the selection of various treatment methods for industrial wastewater treatment
3. Understand concepts in industrial solid waste management
4. Implement the sophisticated wastewater supply technology
5. Execute solutions for biological treatment
6. Implement new techniques for collection, recycling and disposal of solid wastes and sludge

Module: 1	Sources and types of Industrial wastes	3 hours
Liquid, solid, and gaseous waste - effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health		
Module: 2	**Recent trends in Industrial waste management**	**3 hours**
Cradle to Grave concept - life cycle analysis - clean technologies		
Module: 3	**Treatment of specific pollutants in industrial waste**	**4 hours**
Fluoride – cyanide - Toxic organics - Heavy metals – Radioactivity		
Module: 4	**Liquid Waste Treatment**	**6 hours**
Equalization – Neutralization – Modern treatment techniques: removal of suspended and dissolved organic solids - Removal of dissolved inorganic solids		
Module: 5	**Industrial Solid Waste Treatment**	**6 hours**
Physico-chemical treatment – solidification – incineration – Secured landfills – Legal Provisions		
Module: 6	**Gaseous pollutant treatment**	**3 hours**
Absorption – scrubbing – catalytic oxidation – thermal treatment		
Module: 7	**Various Industrial Pollution Control**	**3 hours**
Treatment processes of selected industries- textiles, tanneries, dairy, sugar, paper, distilleries, steel plants, refineries, fertilizer and thermal power plants.		

Module: 8	**Contemporary issues**	**2 hours**
	Total Lecture hours	**30 hours**

Text Book (s)

1. V. V. Ranade, V. M. Bhandari, Industrial Wastewater Treatment, Recycling and Reuse, Elsevier Publications, 2014.
2. W. Wesley Eckenfelder, Davis L. Ford, Andrew J. Englande, Industrial Water Quality, 4th Ed. Tata McGraw 2009.

Reference Books

1. Patwardhan A.D, Industrial Waste Water Treatment, PHI Learning Private Limited-New Delhi (2009)
2. Arcievala, S.J., "Wastewater Treatment for Pollution Control", Tata McGraw Hill, (2006)
3. Nelson, L. Nemerow, Liquid Waste of Industry, Theories, Practices and Treatment, Addison-Wesley Publishing Company, London, (2008).

Project Titles (J component)	**Hrs.**
Challenging projects for Individual or a group will be given based on the basic and advancements in the course content.	**60 hrs**

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE2019	POLLUTION CONTROL AND MONITORING	L	T	P	J	C
		2	0	0	4	3
Pre-requisite	CLE1006 – Environmental Engineering	Syllabus version				
		1.0				

Course Objectives:

1. To understand the basic concepts of various types of pollution.
2. To understand the factors that must be satisfied for potable water, land and air for the removal and treatment of pollutants.
3. To provide a strong link between the Pollution Damage, Public Authority Control Systems and Technical Control Systems.
4. To know the relationship between social, legislative and biological constraints in a modern developed society.
5. To know about the basics of the standards of noise pollution and methods to prevent air pollution.
6. To develop skills relevant to control the various types of pollution.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Develop a general understanding on types of various industrial pollutions and associated problems.
2. Describe the principles of the biological and chemical treatment processes that are required to ensure adequate quality and quantities of potable water.
3. Implement the principal techniques currently in use for wastewater treatment and to review operational procedures for the plant involved.
4. Apply advanced methods for monitoring and modeling spatial and temporal patterns of pollution.
5. Identify sources, types, and control equipments for industrial air pollution.
6. Determine sources of water pollution, general water treatment, wastewater treatment and issues pertaining water quality degradation.
7. Develop management techniques for degraded landforms due to industrial activities.

Module: 1	Pollution: An overview	4 hours

Pollution control regulations of India: water, air, noise, solid and hazardous waste- Agencies involved and structure of implementation.

Module: 2	Water Pollution	4 hours

Natural process of self- purification in water- BOD consideration in streams – Oxygen Sag Curve- pollution due to industrial, agricultural and municipal wastes- need of water pollution control.

Module: 3	DWWT and ZLD	3 hours

Concept of decentralized wastewater treatment (DWWT) and reuse.
Zero liquid discharge (ZLD) from industries and recycle.

Module: 4	Air Quality Control	4 hours

Air quality criteria and standards- Elements of regulatory and non-regulatory control-Strategies-Indoor air quality.

Module: 5	Noise Pollution	4 hours

Environmental community noise- Measures for prevention and control of noise – Industrial noise and control -Noise measurement and mapping-

Module: 6	**Municipal Solid Waste Management**	**4 hours**
Source characteristics – quantities – collection methods and disposal techniques – sanitary landfill – incineration – and pyrolysis, composting- recycling and reuse.		
Module: 7	**Environmental Sanitation**	**4 hours**
Personal Hygiene and Sanitary Food Handling-Rural and urban sanitation-Traditional and modern methods.		
Module: 8	**Contemporary issues**	**3 hours**
Total Lecture hours		**30 hours**

Text Book (s)

Peavy, H.S., Rowe, D.R and George Tcnobanoglous, Environmental Engineering, Mc-Graw Hill company, New Delhi, (2010).
Rao C. S., Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, (2007).

Reference Books

1. Environmental Pollution Monitoring and Control, S. M. Khopkar, New age International (P) Ltd. publishers, (2010).
2. Environmental Pollution and Control, P. R. Trivedi, JBA publishers, (2008).
3. Environmental Pollution and Control in Chemical Process Industries, S. C. Bhatia, JBA publishers 2nd Edition, Reprint (2014).

Sl. No.	**Sample projects for J component**	**Hrs.**
1.	Study the water pollution status of India / states and identify the sources of pollution and suggest the appropriate water pollution control measures.	**(60 hours)**
2.	Studies and report preparation of DWWT practiced in a community	
3.	Studies and report preparation of ZLD practiced in an industry	
4.	Ambient air quality monitoring of a selected site	
5.	Development of air quality index of a selected town / city	
6.	Studies and report preparation of air pollution control in an industry	
7.	Studies and report preparation of noise pollution control in an industry	
8.	Studies and report preparation of noise pollution control in National Highways	
9.	Studies and report preparation of solid waste management practiced in a community	

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE2020	SOLID WASTE MANAGEMENT	L	T	P	J	C
		2	0	0	4	3
Pre-requisite	CLE1006 – Environmental Engineering	Syllabus version				
		1.0				

Course Objectives:

1. Gain insight into the collection, transfer, and transport of municipal solid waste.
2. Learn the concept of designing and operation of a municipal solid waste landfill.
3. Understand the design and operation of a resource recovery facility.
4. Realize the design and operation of a waste-to-energy facility.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the characteristics of the municipal solid waste
2. Understand the functional element of municipal solid waste management.
3. Understand the separation and processing of municipal solid waste.
4. Know the concept of different alternatives of waste to energy conversation.
5. Design and operate sanitary landfill

Module: 1	Municipal Solid Waste Management: An Overview	6 hours

Definition of solid waste –major legislation, monitoring responsibilities, Effects of improper disposal of solid wastes – public health effects
Sources and types of solid waste – sampling and characterization – Determination of composition of MSW – storage and handling of solid waste.
Collection and Transport of Solid Waste: Waste collection systems– alternative techniques for collection system. Need for transfer operation, transport means and methods.

Module: 2	Municipal solid waste treatment: Materials Recovery	4 hours

Unit operations forseparation and processing, Materials Recovery facilities on site/off site, Composting process

Module: 3	Municipal Solid waste treatment: Energy Recovery	3 hours

Anaerobic digestion, RDF and Incineration and co-generation of energy using waste, Pyrolysis of solid waste

Module: 4	Disposal of municipal Solid wastes	5 hours

Dumping of solid waste; sanitary landfills – site selection, design and operation of sanitary landfills – Leachate collection & treatment

Module: 5	Recyclable solid waste materials for civil engineering applications	3 hours

Construction debris, fly ash, gypsum, red mud, blast furnace slag; e- waste.

Module: 6	Principles of solid and Hazardous waste management	2 hours

Principles of solid waste management, Definition and identification of hazardous wastes, cradle to grave management concept, Prevailing laws of hazardous waste management- Risk assessment.

Module: 7	**Treatment and disposal of hazardous wastes (Biomedical waste, Industrial and nuclear waste)**	**5 hours**
Disinfection, autoclaving, incineration, Stabilization, Solidification, air stripping, oxidation, bioremediation and any other appropriate techniques		
Module: 8	**Contemporary issues**	**2 hours**
	Total Lecture hours	**30 hours**

Text Book (s)

1. George Techobanoglous et al, "Integrated Solid Waste Management ", McGraw- Hill Publication, Latest edition,(2010)
2. Charles A. Wentz; "Hazardous Waste Management", McGraw-Hill Publication, Latest publication, (1992).

Reference Books

1. Handbook of Solid Waste Management by Frank Kreith, George Tchobanoglous, McGraw Hill Publication, (2002).
2. Bagchi, A., Design, Construction, and Monitoring of Landfills, (2nd Ed). Wiley Interscience, ISBN: 0-471-30681-9.
3. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, (2000).

Sl. No.	**List of J sample project topics**	**Hrs.**
1.	Collection and characterization of solid and hazardous waste	60 hrs.
2.	Devise appropriate treatment options based on varying characteristics	
3.	Route optimization studies for collection of solid waste	
4.	Economic appraisal of a selected waste management scheme	

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE2022	ECONOMICS AND BUSINESS FINANCE FOR CIVIL ENGINEERS	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	CLE1007 – Construction Materials and Techniques	Syllabus version				
		1.0				

Course Objectives:

1. To enables the Civil Engineering student to become an entrepreneur by understanding the law of economics.
2. To ensure the students to apply different Methods of appraisal of projects and pricing techniques apart from knowing about various Macroeconomics Model.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Know the Scope and Method of Managerial economics along with Fundamental Economics and help them to develop a thorough understanding on engineering decision making.
2. Analyse the demand and supply adopting market strategy
3. Understand the production function and factors affecting it with various economy conditions of the firm.
4. Study the different types of market structure and strategies
5. Examine behaviour of markets adopting game theory and pricing practices.
6. Understand the concepts of macroeconomics and obtain knowledge of government fiscal and monetary policies.
7. Implement the of various macroeconomic models for markets.
8. Learn the computer applications in economics.

Module: 1	Introduction	5 hours

The Scope and Method of Managerial economics - Fundamental Economics concepts - Managerial Economics with other subjects - Objectives of the Firm.

Module: 2	Demand and Supply Analysis	6 hours

Meaning, Types and Determinants - Demand estimation - Demand elasticities for decision making - Business and Economic forecasting : Qualitative and Quantitative methods - Supply analysis: Meaning, elasticities and determinants - Market equilibrium and price determination

Module: 3	Production Economics	6 hours

Production and Production function - Types - Estimation - Returns to Scale - Economies and Dis-economies of Scale and Economies of Scope. Factor Inputs - Input-Output Analysis

Module: 4	Market Structure	6 hours

Perfect Competition - Imperfect Competition: Monopoly - Monopolistic - Oligopolistic Strategy, Cartels, Cournot, Kinked Demand and Price Leadership.

Module: 5	Pricing Structure	7 hours

Oligopolistic Rivalry \ & Theory of Games - Measurement of economic concentration - Policy against monopoly and restrictive trade practices - Competition Law - Pricing Practices : Objectives - Determinants - Pricing Methods - Government Policies and Pricing

Module: 6	Introduction to Macroeconomics	7 hours

Circular Flow of Income and Expenditures - Components of National Income and its significance - Measuring Gross Domestic Product (GDP) - Inflation and Business Cycles - Government Fiscal and Monetary Policy - Balance of payments - Foreign exchange markets

Module: 7	**Macroeconomics Model**	**6 hours**
Classical Model - Keynesian Cross Model - Investment Theory - Hybrid Model - IS-LM-BP Model		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**45 hours**

Text Book (s)	
1.	Bose, D. C., "Fundamentals of Financial management", 2nd ed., PHI, New Delhi, (2010).
2.	Peterson, S. J., "Construction Accounting and Financial Management", Pearson Education, Upper Saddle River, New Jersey, (2015).
Reference Books	
1.	Jha, K. N., "Construction Project Management, Theory and Practice", Pearson, New Delhi, (2011).
2.	Newnan, D. G., Eschenbach, T. G. and Lavelle, J. P., "Engineering Economic Analysis", Indian Edition, Oxford University Press, (2010).
Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test	

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE2023	GIS AND REMOTE SENSING	L	T	P	J	C
		2	0	2	0	3
Pre-requisite	CLE1003 – Surveying	Syllabus version				
		1.0				

Course Objectives:

1. To understand the basic concepts of remote sensing.
2. To learn basic concepts of Geo-graphical Information Systems (GIS).
3. To know various applications of Remote Sensing and GIS applications in Civil Engineering
4. To know the importance of decision making system.
5. To understand the importance of Remote Sensing and GIS in Disaster Mitigation and Management.
6. To understand the importance of digital elevation model (DEM) in various water resources engineering applications.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Identify the Indian remote sensing satellites and their platforms
2. Present available GIS and Remote Sensing software like ARC GIS, QGIS and ERDAS Imagine.
3. Develop Digital Elevation Model (DEM)
4. Develop Land use land cover analysis,
5. Generate spectral library
6. Understand the importance of GIS and Remote Sensing in Civil Engineering

Module: 1	Basic concepts of Remote Sensing	4 hours

Introduction to Remote Sensing, Electromagnetic Spectrum and radiation, Remote Sensing Platforms, Satellite Sensors, Orbits in Remote Sensing

Module: 2	Sensors and Scanning Systems	4 hours

Indian Remote Satellites (IRS), Spectral characteristics earth surface features i.e, vegetation, water and soil, Understanding the spectral curves to create spectral library

Module: 3	Digital Image processing	5 hours

Elements of image interpretation , Concepts of digital image processing, Image registration, Feature extraction techniques, Image classification, Land use and land cover analysis

Module: 4	Basic concepts of GIS	4 hours

Introduction to GIS, History of development of GIS, Elements of GIS - Computer hardware and software, Map reading, various maps in GIS

Module: 5	Spatial Analysis tools	4 hours

Map overlay operations, Vector and Raster data model, Data storage and database management, Spatial data analysis techniques

Module: 6	Introduction and Principles of Photogrammetry	4 hours

Type of Photogrammetry, Stereoscopic Instruments / views, Vertical Photography, Ortho-photos, Oblique Photographs, Topographic Mapping , Digital Elevations/ Terrain Modelling

Module: 7	Applications of remote sensing and GIS	3 hours

Application of remote sensing and GIS in Civil Engineering, Case studies

Module: 8	Contemporary issues	2 hours
	Total Lecture hours	**30 hours**

Text Book (s)

1. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, New Delhi, Second Edition, (2012)

Reference Books

1. Thomos Lille sand, Ralph W. Kiefer and Jonathan Chripman, Remote Sensing and Image Interpretation, Wiley Publisher, 7th Edition, (2015).
2. Peter A. Burrough, Rachael A. McDonnell and Christopher D. Lloyd, Oxford University Press, 3rd Edition, (2015).
3. Kang-tsung Chang, Introduction to Geographic Information Systems, McGraw-Hill Education; 8th Edition, (2015).
4. G S Srivastava, An Introduction to Geoinformatics, McGraw Hill Education (India) Private Limited, (2014).
5. Paul Wolf, Bon DeWitt and Benjamin Wilkinson, Elements of Photogrammetry with Application in GIS, McGraw-Hill Education; 4th Edition, (2014).

Laboratory Exercises	**hours**
1. Image Registration (Image to Image, Image to Map).	2 hours
2. Image Subset / Clipping.	2 hours
3. Spectral Signature of various land features.	2 hours
4. Image Classification from satellite data sets.	2 hours
5. Land use and land cover Analysis.	2 hours
6. Importing scanned and image file to GIS platform.	2 hours
7. Digitization, attribute assigning, Raster to Vector formats.	3 hours
8. Creating Thematic Layers/ Maps.	3 hours
9. Spatial Analysis (Overlay, Buffering etc.).	3 hours
10. DEM/DTM generation.	3 hours
11. Extraction of Topographic parameters (slope, aspects, drainage etc.,) includes map creation.	3 hours
12. Open Source data access	3 hours
Total	30 hours

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE3004	ADVANCED STRUCTURAL ANALYSIS	L	T	P	J	C
		2	2	2	0	4
Pre-requisite	**CLE2003 – Structural Analysis**	**Syllabus version**				
		1.2				

Course Objectives:

1. To study the multi storey frames subjected to gravity loads and lateral loads
2. To study the behavior of plastic analysis
3. To know the concepts of flexibility and stiffness methods for structural analysis
4. To obtain the knowledge of thermal and initial strain
5. To know the basics of finite element modeling of structures

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Analyze multistory frames subjected to gravity loads and lateral loads
2. Know the importance of the shape factor
3. Analyse beams and frames using flexibility and stiffness methods.
4. Evaluate thermal strain for various boundary conditions.
5. Understand the concept of finite element method.

Module: 1	**Approximate methods for gravity loads**	**3 hours**
Substitute frame method for dead load and live loads		
Module: 2	**Approximate methods for lateral loads**	**3 hours**
Calculation of wind load, portal method - cantilever method - Factor method.		
Module: 3	**Plastic Analysis**	**4 hours**
Shape factor - simple sections - rectangular - triangle - circular - flanged sections - Load factor. Plastic moment of resistance - collapse load - analysis of continuous beams and portals - limiting conditions for applications.		
Module: 4	**Flexibility Method**	**5 hours**
Flexibility - compatibility equation - flexibility influence coefficients - force transformation matrix - flexibility matrix-analysis of beams & frames (rigid and pin-jointed).		
Module: 5	**Stiffness Method**	**5 hours**
Direct stiffness method - equivalent joint load - transformation matrix - development of structure stiffness matrix for axial element - assembly of structure stiffness matrix from element stiffness matrix - incorporation of boundary conditions.		
Module: 6	**Special Issues in Analysis of Structures**	**4 hours**
Thermal and initial strain (temperature change and misfit) - Displacement boundary conditions.		
Module: 7	**Introduction to Finite Element Method**	**4 hours**
Introduction to basics of Finite Element modelling.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**
Tutorial • A minimum of 3 problems to be worked out by students in every tutorial		**30 hours**

class. • 5 problems to be given as homework per tutorial class. Tutorial Class for Module 1 Tutorial Class for Module 2 Tutorial Class for Module 3 Tutorial Class for Module 4 Tutorial Class for Module 5 Tutorial Class for Module 6 Tutorial Class for Module 7	

Text Book (s)

1. Aslam Kassimali, Matrix Analysis of Structures, 2nd Edition, CENGAGE Learning Custom Publishing, 2011.
2. C.S. Reddy, Basic Structural Analysis,3rd Edition, Tata Mcgraw Hill Education, 2014

Reference Books

1. Igor A. Karnovsky and Olga Lebed, Advanced methods of Structural Analysis, Springer New York. 2010.
2. C. Natarajan and P. Revathi, Matrix methods of Structural Analysis: Theory and Problems, PHI Pvt Ltd, India, 2014.
3. Pandit, G.S, & Gupta S.P, Structural Analysis (A matrix approach), Tata McGraw Hill Publishing Ltd., 2008.

Laboratory Exercises	**hours**
1. Analyse a pin jointed static determinate truss	3 hours
2. Analyse a pin jointed static indeterminate truss	3 hours
3. Analyse a continuous beam with different types of loading	3 hours
4. Analyse a portal frame with different type of loading	3 hours
5. Verification of portal method assumption and analysis for different bays	3 hours
6. Verification of cantilever method assumption and analysis for different bays	3 hours
7. Analysis of a 3 D truss	4 hours
8. Analysis of a 3D frame	4 hours
9. Modeling of a simple plan of a structure	4 hours
Total	**30 hours**

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE3005	GROUND WATER ENGINEERING	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	**CLE2004 – Water Resources Engineering**	**Syllabus version**				
		1.0				

Course Objectives:

1. To learn about the importance of groundwater occurrence, movement and its importance in hydrologic cycle
2. To become familiar with aquifer types and aquifer parameters
3. To derive groundwater flow equations for confined and unconfined aquifers under steady and unsteady flow conditions
4. To understand well hydraulics, and in-situ tests for determining drawdown and flow through wells
5. To be able to comprehend groundwater pollution, its causes and methods for controlling groundwater pollution

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the occurrence, movement, types, and various parameters of groundwater system
2. Solve the equations for steady and unsteady flow through confined and unconfined aquifers
3. Understand about the types of wells and their functioning
4. Identify the process and methods for analyzing results from a pumping test
5. Understand the causes and sources of groundwater pollution and the remedial measures to be adopted to control groundwater pollution
6. Solve groundwater flow equations through numerical methods

Module: 1	**Occurrence and Movement of Groundwater**	**6 hours**

Introduction to Hydrologic cycle – Origin and Age of groundwater- Vertical distribution of groundwater.

Module: 2	**Types of Aquifer and groundwater movement**	**5 hours**

Aquifer - water table - Darcy's Law, Coefficient of Transmissibility and storage – Determination of hydraulic conductivity-groundwater flow rates.

Module: 3	**Well Hydraulics**	**6 hours**

Steady Unidirectional flow -Study of steady radial flow – Unsteady radial flow in a confined and Unconfined aquifer –Multiple well system.

Module: 4	**Water Well**	**4 hours**

Characteristic well losses, open well, tube well, well depth, well screen – Slug tests

Module: 5	**Analysis and Evaluation of Pumping Test**	**7 hours**

Definition of terms - static water level, pumping level, drawdown – residual, drawdown pumping rate - automatic water level recorder - time drawdown analysis - distance drawdown analysis, Jacob's methods, pumping test methods.

Module: 6	**Pollution of Groundwater**	**7 hours**

Measures of water quality- chemical analysis - graphical representation-physical analysis -

biological analysis - Pollution in relation to water use - sources, municipal, industrial, agricultural, evaluation of pollution potential. Remedial measures for ground water contamination.		
Module: 7	**Management of Groundwater and Groundwater Flow Modelling Techniques**	**8 hours**
Concepts of Basin Management-Groundwater basin Investigations and data collection-Yield-Conjunctive use and Watershed management - Water laws and policies Types of groundwater models - simulation of two and three dimensional groundwater system-MODFLOW 2000		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**45 hours**

Text Book (s)

1. David K Todd and Larry W. Mays (2013), Groundwater Hydrology, Third Edition, John Wiley & Sons Singapore.

Reference Books

1. Rastogi R K, Applied groundwater hydrology, (2011).
2. Raghunath H.M., Groundwater, Second Edition, Wiley Eastern Limited, New Delhi, (2012).

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE3007	TRAFFIC ENGINEERING	L	T	P	J	C
		2	0	0	4	3
Pre-requisite	CLE2005 – Transportation Engineering	Syllabus version				
		1.0				

Course Objectives:

1. To provide understanding on basic traffic characteristics and various models describing the relationship among traffic stream parameters
2. To train students to collect and analyze traffic data
3. To prepare students to perform capacity and level of service analysis of a highway
4. To teach students to perform traffic signal design using IRC guidelines
5. To make students aware of traffic regulations and measures to manage traffic
6. To enable students to understand the importance of roadway safety and accident analysis

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Describe traffic stream parameters and their relationship
2. Identify various traffic stream models and their application
3. Collect the traffic data and analyse it using statistical tools.
4. Evaluate capacity and level of service for a given highway
5. Design traffic signal using IRC guidelines
6. Describe various measures of traffic regulations and management
7. Collect the data related to accidents and identify accident hot spots

Module: 1	Basic Concept of Traffic Characteristics	4 hours

Parameters used to describe a traffic stream – Macroscopic and microscopic level - Flow, Speed, Density – Time headway, Time mean speed, Space headway - Their basic relationship – Fundamental traffic flow equation

Module: 2	Traffic Stream Models	4 hours

Introduction to traffic stream models – Greenshield's, Greenberg, Underwood, Northwestern models – Application of traffic stream models – Shock waves

Module: 3	Traffic Studies	5 hours

Traffic studies – Volume, speed, density, time headway, space headway, travel time and parking – Methods of data collection – Statistical analysis – Application of Poisson model – Gap acceptance studies – Queueing models

Module: 4	Highway capacity and Level of service	4 hours

Basic definitions related to capacity – Level of service (LOS) concept – Factors affecting capacity and LOS – Computation of capacity and LOS for 2-lane highways – Multilane highways – Freeways – IRC guidelines

Module: 5	Traffic Signals	4 hours

Traffic signals – Warrants for signalization – Design of traffic signal by Webster method – Signal coordination and area traffic control – IRC guidelines

Module: 6	Traffic Regulations and Management	4 hours

Introduction to Transportation System Management (TSM) - Measures for improving vehicular flow – one way streets, transit stop relocation, parking management, reversible lanes -

Reducing Peak Period Traffic - Strategies for working hours - Congestion Pricing - Traffic signs and roadway markings - Types, specification		
Module: 7	**Roadway Safety**	**3 hours**
Purpose of accident studies - Accident data collection – Identification of accident hot spots - Use of Global Positioning Systems (GPS) and Geographic Information Systems (GIS) – Causative factors of road accidents - Predictive models - Road Safety Auditing - Measures to increase Road safety.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**

Text Book (s)

1. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski (2012) "Principles of Highway Engineering and Traffic Analysis", John Wiley & Sons.

Reference Books

1. Nicholas Garber, Lester A. Hoel,"Traffic and Highway Engineering", 5th Edition, Cengage Learning, USA, (2015).
2. L.R. Kadiyali, N. B. Lal, "Traffic Engineering and Transport Planning", Khanna Publishers, New Delhi, India, (2011).

Project Titles (J component)	**Hrs.**
Challenging projects for Individual or a group will be given based on the basic and advancements in the course content	**60hrs**

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE3008	TRANSPORT PLANNING AND MANAGEMENT	L	T	P	J	C
		2	0	0	4	3
Pre-requisite	**CLE2005 – Transportation Engineering**	**Syllabus version**				
		1.0				

Course Objectives:

1. To familiarize students with the transportation planning process and four step travel demand forecasting process.
2. To enable students to plan and organize a data collection program for travel demand modelling.
3. To teach students how to analyse travel data and prepare inputs for travel demand model development.
4. To assist students to prepare and apply a basic trip generation model.
5. To train students to select suitable basic trip distribution models and apply it for given data.
6. To prepare students to describe and apply basic mode choice models.
7. To facilitate the students to perform a basic traffic assignment procedure on a given network.
8. To demonstrate how to perform a basic economic evaluation of a given set of transportation projects.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Describe the transportation planning process and four step travel demand forecasting process.
2. Plan and organize a data collection program for travel demand modelling.
3. Analyse travel data and prepare inputs for travel demand model development.
4. Prepare and apply a basic trip generation model
5. Describe and apply basic trip distribution models for given data.
6. Apply basic mode choice models.
7. Perform a basic traffic assignment procedure on a given network.
8. Perform a basic economic evaluation of a given set of transportation projects.

Module: 1	**Transport Planning Process**	**6 hours**

Scope – Urban transportation systems - Systems approach to transportation planning – Long term vs Short term – Simultaneous vs sequential approaches – Aggregate vs disaggregate approaches.

Module: 2	**Transportation Planning Surveys**	**3 hours**

Transport survey – definition of study area and traffic zones – External cordon line – Sample size – Home interview survey and cordon line surveys - inventory of existing transport facilities, land use and economic activities.

Module: 3	**Trip Generation**	**4 hours**

Factors governing trip generation: physical, social and economic – multiple regression analysis – category analysis

Module: 4	**Trip Distribution**	**4 hours**

Presentation of Trip distribution data – PA matrix to OD matrix - Growth factor methods - Gravity model and its calibration – opportunities model.

Module: 5	**Modal Split Analysis**	**4 hours**
Factors influencing mode choice – Modal split models – Trip end and trip interchange – Disaggregate mode choice models - Discrete choice models		
Module: 6	**Traffic assignment**	**4 hours**
Traffic assignment – general principles – description of highway network – Moore's shortest path algorithm - assignment techniques – all nothing assignment – capacity restrained assignment – diversion curves		
Module: 7	**Transport Economics**	**3 hours**
Economic evaluation techniques – Benefit cost ratio, NPV method, IRR method – Comparison – Examples		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**

Text Book (s)

1. L.R. Kadiyali, Traffic Engineering and Transport planning, Khanna Publishers, New Delhi, (2011).

Reference Books

1. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, John Wiley & Sons, (2012).
2. Papacostas and Prevedouros, Transportation Engineering and Planning, Pearson, India, (2015).

Project Titles (J component)	**Hrs.**
Challenging projects for Individual or a group will be given based on the basic and advancements in the course content	60 hrs

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE3010	ARCHITECTURE AND TOWN PLANNING	L	T	P	J	C
		2	0	0	4	3
Pre-requisite	CLE2001 – Building Drawing	Syllabus version				
		1.1				

Course Objectives:

1. To learn the Architectural aspects and to understand the history of Romans, Greek, and South Indian Architecture.
2. To know the different type of architectures and its importance
3. To understand the basic principles of town planning
4. To Understand interior planning and design
5. To Know the challenges of SMART cities

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the creative process to improve the user-friendly experience in space
2. Improve communicative skills and emotional strength in presenting ideas through 2D and 3D form
3. Comprehend the past, follows present, ascendance the future
4. Interpretation of idea through study and planning of workable efficiency of town and city
5. Understand the long term development path without compromising the present for future

Module: 1	Basics of Architecture	6 hours

Principles of architectural composition – unity, balance, proportion, scale, contrast, harmony, accentuation, restraint, definition, repose, vitality, strength - with the help of illustrations of buildings,

Organizing principles of architectural composition – symmetry, hierarchy, datum, axis, rhythm – different types of spatial organizations of masses – linear, centralized, radial, clustered, grid organization – illustrations of buildings.

Use of different materials - Styles in architecture - Anthropometrics , furniture layout - circulation - lighting and ventilation for spaces

Module: 2	Skills for an Architectural Understanding	3 hours

Various Drawing Skills - Visualization Skills - Model Making skills - Thinking & Analytical Skills - Empathy - Philosophical Understanding from Idea to Form - Psychological and Social Understanding

Module: 3	Architecture in Timeline	5 hours

Understanding the construction methods and materials through study of Egyptian, Greek, Roman, European, Indian Architectural History - Modern Architecture - Contemporary Architectural Practice

Module: 4	Interior Design	3 hours

Interior Planning and treatment – Use of natural and synthetic building materials – Thermal and Accoustical materials – Furniture and Fittings.

Module: 5	Human Settlements	4 hours

Planned and organic - typologies of cities like Capital, Port, Rural etc- Elements of human settlements

Module: 6	**Town Planning Principles**	**4 hours**
Planning ideologies – Importance of Climate topography, drainage and water supply in the selection of site for the development – Residential – Commercial – Industrial – Public – Transportation, Utility and services – Agriculture.		
Module: 7	**Smart Cities - Opportunities And Challenges**	**3 hours**
Indian scenario - need for smart cities - Issues and Opportunities. Green Building.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**

Text Book (s)

1. De Charia & Callender, Architecture, Mc. Graw Hill, (2012).

Reference Books

1. Gallion, Urban pattern City planning and design, Charotar Publishing House, (2010).
2. Modak & Ambedkar, Town and Country Planning and Housing, (2001).

Sl. No.	Sample projects - J component	Hrs.
1.	Design of a Restaurant / any other medium sized project that calls for both interior and exterior design.	60 hours
2.	Intervene with Architecture / Town planning solution to a localized social or urban Issue.	
3.	Green Ideation projects	
4.	Architectural projects that carry more structural design emphasis.	
5.	Smart City (intervention) solutions Projects	

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE3011	FINITE ELEMENT METHODS	L	T	P	J	C
		2	2	0	0	3
Pre-requisite	CLE2003 – Structural Analysis	Syllabus version				
		1.1				

Course Objectives:

1. To provide fundamental concepts of finite element method.
2. To introduce procedures and principles to carry out finite element analysis.
3. To provide understanding of numerical techniques and its application to structures.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the concept of finite element methods
2. Identify finite elements in a given application and generate governing equations.
3. Apply finite element principles to one-dimensional elements.
4. Apply finite element principles to two-dimensional elements.
5. Identify and solve problems using numerical techniques.
6. Identify and relate coordinate systems of structures.

Module: 1	Introduction	4 hours

Concepts of finite element methods - Steps involved - merits and demerits - Energy principles - Discretization.

Module: 2	Principles of Elasticity	4 hours

Equations of equilibrium - Stress equations - Stress - strain relationship - Strain - displacement matrix - Plane stress and plane strain conditions.

Module: 3	Theory of Finite Element methods	4 hours

Concept of an element - Various element shapes - Displacement models - Approximation displacements by polynomials - Convergence requirements - Shape functions.

Module: 4	One dimensional FEM	4 hours

Stiffness matrix for bar and beam element - one dimensional problems.

Module: 5	Two dimensional FEM	4 hours

Minimization of band width - Analysis of two dimensional framed structures (trusses, frames) for loads and displacements.

Module: 6	Natural coordinate system	4 hours

Area and volume coordinates - Lagranges's and serendipity elements - Numerical integration techniques.

Module: 7	Isoparametric formulation	4 hours

Concepts of isoparametric formulation - Iso parametric Bar element - Plane bilinear isoparametric element.

Module: 8	Contemporary issues	2 hours

Total Lecture hours	**30 hours**
Tutorial • A minimum of 3 problems to be worked out by students in every tutorial class. • 5 problems to be given as homework per tutorial class. Tutorial Class for Module 1 Tutorial Class for Module 2 Tutorial Class for Module 3 Tutorial Class for Module 4 Tutorial Class for Module 5 Tutorial Class for Module 6 Tutorial Class for Module 7	**30 hours**

Text Book (s)

1. Krishnamoorthy, C. S, "Finite Element Analysis", Tata McGraw Hill Publishing Co. Ltd., 2015

Reference Books

1. Tirupathi R. Chandrupatla and Ashok D. Belugundu, Introduction to Finite Elements in Engineering, Prentice Hall, (2011).
2. Mukhopadhyay, M., & Sheikh, A. H., Matrix and finite element analyses of structures, Ane Books, (2011).
3. Larson, M. G., Finite element method: theory, implementation, and applications, Springer, (2013).

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	27.09.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017

CLE4001	DESIGN OF STEEL STRUCTURES	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**CLE3002 – Basics of Structural Design**	**Syllabus version**				
		1.0				

Course Objectives:

1. To learn the behavior and design of structural steel.
2. To gain an educational and comprehensive experience in the design of steel structures.
3. To apply the principles, procedures and current code requirements to the design of steel structural members

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the behavior and design the framed steel structures
2. Identify and compute the design loads for industrial structures
3. Apply the concepts and design steel water tanks
4. Design the light gauge steel structures
5. Design the Steel Gable Frames
6. Understand the design of steel-concrete composite structures
7. Develop complete drawings of steel structures including all details of sections and connections.

Module: 1	**Braced and Moment Frames**	**6 hours**
Design of braced frames – moment frames.		
Module: 2	**Design of industrial structures**	**7 hours**
Roof Trusses - calculation of dead load- live load & wind load - Design of joints - supports - members for pitched roof truss - purlins.		
Module: 3	**Water Tanks**	**7 hours**
Overhead water tanks - pressed steel tanks - design of staging and foundation.		
Module: 4	**Light Gauge Sections**	**7 hours**
Design of light gauge steel members - local and post buckling of thin element - light gauge steel compression members - tension members - beams and connections.		
Module: 5	**Design of Steel Gable Frame and Beam Columns**	**6 hours**
Design of steel gable frame - beam column - base plate and anchor bolt.		
Module: 6	**Design of Steel, concrete composite structures**	**6 hours**
Dimensions of steel stacks - loading and load combinations. Slabs, Beams, Columns		
Module: 7	**Detailing of Steel Structures**	**4 hours**
Detailing and drawing of frames - water tanks - gable frames		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**45 hours**

Text Book (s)			
1. Subramanian, N," Design of Steel structures", Oxford University press, New Delhi, 2011.			
Reference Books			
1. Ramchandra. S., Virendra Ghelot, "Design of Steel of Structures", Volume 1, Scientific Publishers, New Delhi, 2011 2. Duggal .S. K. "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, New Delhi, 1st Edition, 2010. 3. Bhavikatti S. S. "Design of Steel Structures by Limit State Method as Per IS: 800 - 2007", I. K. International Pvt. Ltd., 2009.			
Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test			
Laboratory Exercises			hours
Design and drawing of • Water tanks			**10 hours**
• Steel roof trusses			**10 hours**
• Gable frames			**10 hours**
Total			**30 hours**
Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE4002	DESIGN OF ADVANCED CONCRETE STRUCTURES	L	T	P	J	C
		2	0	0	4	3
Pre-requisite	CLE3002 – Basics of Structural Design	Syllabus version				
		1.0				

Course Objectives:

1. To understand the design of columns
2. To understand the design of bridges
3. To know the importance of the retaining wall and its applications
4. To apply the numerical techniques for different structural elements
5. To study the different numerical procedures for calculating the response of structures
6. To learn the design of frames, slabs.
7. To learn the design of retaining wall, tank and deck slab for bridge.
8. To learn the application of numerical method in shear force - Bending moment.
9. To evaluate stability and analyze plate.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the theories of slabs.
2. Design the structural frame members.
3. Understand the concepts of frame analysis.
4. Design the retaining walls.
5. Design the water tanks.
6. Design the bridges and deep beams.

Module: 1	Yield line theory of slab design	3 hours

Yield line theory - Assumptions made in analysis - Hillerborg's Theory - Analysis of isotrophic conditions - virtual work method and equilibrium method.

Module: 2	Design of Structural frames	3 hours

Design of Stair Case - Design of slender columns - uni-axial and biaxial bending

Module: 3	Introduction to frame analysis	4 hours

Substitute frame method - cantilever method and portal frame method.

Module: 4	Retaining Walls	5 hours

Design of walls - cantilever and counter fort retaining walls.

Module: 5	Water Tanks	5 hours

Design of under - ground rectangular tanks - circular tank -Design of over-head rectangular tanks - circular tank – domes.

Module: 6	Design of Bridges	5 hours

Classification of bridges - IRC code - Pigeaud's method - Coulomb's method - design of slab bridge

Module: 7	Design of Deep beams	3 hours

Design of simply supported and continuous deep beams.

Module: 8	Contemporary issues	2 hours
	Total Lecture hours	**30 hours**

Text Book (s)

1. Bhavikatti S, (2016), Advanced RCC Design (Volume 1 and Volume 2), New Age International.

Reference Books

1. Varghese, P.C, "Advanced Reinforced Concrete Design", Prentice-Hall of India, New Delhi, 2011.
2. Ramamrutham S, Design of Reinforced Concrete Structures, Dhanpat Rai Publishers, 2016.
3. Gambhir. M. L. “Design of Reinforced Concrete Structures”, Prentice Hall of India, 2012.
4. Unnikrishna Pillai and Devdas Menon “Reinforced Concrete Design’, Third Edition, Tata McGraw Hill Publishers Company Ltd., New Delhi, 2017.
5. IS 456: 2000 Plain and Reinforced Concrete - Code of Practice.
6. IS 13920 Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces - Code of Practice.
7. IS 3370 Water Retaining Structures.
8. IRC Specifications.

Samples projects for J component	hours
1. Study influences of the yield line theory and practicality study on the slabs 2. Functional requirements of staircases and design of stair case 3. Identifying the parameters influencing and design limitations in the long columns 4. Flawless design and detailing of RCC structural components 5. Design of a retaining wall for a minor bridge 6. Design of a high-steep reinforced soil retaining wall 7. Design and analysis of rectangular water tank resting on ground 8. Seismic Behavior & Design of RC Shear Walls 9. Influence of orientation of shear walls on structural behavior of RC buildings 10. Design of flat slab for a commercial building 11. Comparison of structural behavior of conventional roof and flat slab system 12. Design of a deep beam for an aesthetic building 13. Design of a arch bridge 14. Design of a railway bridge	60 hours

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE4003	PRESTRESSED CONCRETE DESIGN	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	CLE3002 – Basics of Structural Design	Syllabus version				
		1.0				

Course Objectives:

1. To learn the principles, materials, methods and systems of prestressing
2. To know the different types of losses and deflection of prestressed members
3. To learn the design of prestressed concrete beams for flexural, shear and tension and to calculate ultimate flexural strength of beam
4. To learn the design of anchorage zones, composite beams

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the concepts of pre-tensioning and post-tensioning members
2. Analyse the flexural member.
3. Design a prestressed concrete beam accounting for losses
4. Calculate the deflection and crack width of prestressed members
5. Design the flexural member.
6. Design the member subjected to shear.
7. Design the composite members

Module: 1	Introduction	6 hours

Concept of Prestressing - Types of Prestressing - Advantages - Limitations -Prestressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete.

Module: 2	Analysis of members	6 hours

Analysis of members at transfer - Stress concept - Comparison of behavior of reinforced concrete - prestressed concrete - Force concept - Load balancing concept - Kern point - Pressure line.

Module: 3	Losses in Prestress	6 hours

Loss of Prestress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss.

Module: 4	Deflection and Crack Width	6 hours

Calculations of Deflection due to gravity loads - Deflection due to prestressing force - Total deflection - Limits of deflection - Limits of span-to-effective depth ratio - Calculation of Crack Width - Limits of crack width.

Module: 5	Design of Sections for Flexure	6 hours

Analysis of members at ultimate strength - Preliminary Design - Final Design for Type 1 members - Magnel's graphical method

Module: 6	Design for Shear	6 hours

Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.

Module: 7	Design of Deep beams	6 hours

Design of simply supported and continuous deep beams.

Module: 8	**Contemporary issues**	**3 hours**
Total Lecture hours		**45 hours**

Text Book (s)

1. Krishna Raju. N., Pre-stressed Concrete - Problems and Solutions, CBS Publishers and Distributors, Pvt. Ltd., New Delhi, 2014.

Reference Books

1. Praveen Nagarajan, Advanced Concrete Design, Person, 2013
2. P. Dayaratnam, Prestressed Concrete Structures, Oxford & IBH-Pubs Company, Delhi, 5th Edition, 2009
3. IS: 1343: Indian Standard code of practice for Prestressed concrete, BIS, New Delhi.
4. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

CLE4004	SEISMIC DESIGN OF STRUCTURES	L	T	P	J	C
		2	2	0	0	3
Pre-requisite	CLE3002 – Basics of Structural Design	Syllabus version				
		1.1				

Course Objectives:

1. To introduce the basics of Earthquake Engineering
2. To introduce the engineering seismology, building geometrics & characteristics, structural irregularities,
3. To develop guidelines for earthquake engineering
4. To discuss code provisions and their application on different types of structures

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Apply the basics of Earthquake Engineering
2. Demonstrate the dynamics of structural system under earthquake load
3. Understand the principles of earthquake resistant design
4. Analyze the influence of the structural / geometrical design in building characteristics
5. Design the beam column junctions in buildings subjected to earthquake loads.
6. Design a shear wall to resist the earthquake loads
7. Apply codal provisions on different types of structure

Module: 1	Seismology and earthquake	4 hours

Internal structure of the earth - discontinuity and nature of the material - continental drift and plate tectonics - Faults - Elastic rebound theory - seismic waves and characteristics - earthquake size - seismic zoning map of India.

Module: 2	Dynamics of structures	3 hours

Theory of vibrations - free and forced vibrations - single and multi-degree of freedom systems - computations of dynamic response to time dependent forces.

Module: 3	Principles of earthquake resistant design	5 hours

Importance of Earthquake Resistant Design - Seismic Forces - modes of propagation - Factors influencing seismic vulnerability - Characteristics of earthquake - Earthquake response of structures - Application of response spectrum theory in seismic design - Concept of earthquake resistance design - Codal provisions for seismic design of structures – IS 1893 and IS 4326.

Module: 4	Seismic analysis of moment resisting frames	4 hours

Seismic design philosophy, determination of design lateral forces as per IS: 1893 - equivalent static force and dynamic analysis procedure - Effect of infill stiffness on analysis of frames - equivalent diagonal strut.

Module: 5	Design of beam column junctions	3 hours

Elastic and Inelastic deformations of structures - ductility of the composite system - design of axial and flexural members - beam column junction detailing - strong column weak beam effects as per IS: 13920.

Module: 6	Design of shear walls	4 hours

Unreinforced and reinforced masonry shear walls - analysis and design of reinforced concrete shear

walls - Bearings - Friction dampers - Tuned mass dampers.		
Module: 7	**Design of structures**	**5 hours**
Seismic design of RC structures using - static and dynamic methods - equivalent static, response spectrum and time history methods.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**

Text Book (s)

1. Pankaj Agarwal and Manish Shrikhande, Earthquake resistant design of structures, Prentice-Hall India Pvt. Ltd., 2012
2. Duggal, S.K, "Earthquake Resistant Design of Structures", Oxford university press, 2007.

Reference Books

1. Park, R & Paulay, "Design of Reinforced Concrete Structure Elements", John Wiley & sons, 2009.
2. Kramer. S. L, "Geotechnical Earthquake Engineering", Prentice-Hall India Pvt. Ltd., 2010.
3. IS: 1893 (Part 1)-2002, Criteria for earthquake resistant design of structures, BIS, New Delhi.
4. IS: 13920-1993, Ductile detailing of reinforced concrete structures subjected to seismic forces, BIS, New Delhi.

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	04.03.2016		
Approved by Academic Council	40th ACM	**Date**	18.03.2016

MEE1024	OPERATIONS RESEARCH	L	T	P	J	C
		2	2	0	0	3
Pre-requisite	**MAT2001 – Statistics for Engineers**	**Syllabus version**				
Anti-requisite	Nil	1.1				

Course Objectives:

1. To provide students the knowledge of optimization techniques and approaches.
2. To enable the students apply mathematical and computational needed for the practical utility of Operations Research.
3. To teach students about networking, inventory, queuing, decision and replacement models.

Expected Course Outcome:

Student will be able to

1. Illustrate the use of OR models like LPP, Transportation etc., in a wide range of applications in industries.
2. Analyze various OR models like inventory, queuing, simulation, and decision etc. and apply them for optimization.
3. Gain knowledge on current topics and advanced techniques of Operations Research for industrial solutions.

Module: 1	**Linear Programming Problem**	**4 hours**

Introduction to Operations Research – Linear Programming - Mathematical Formulation – Graphical method – Simplex method – Penalty methods: M-method, Two Phase method- Duality.

Module: 2	**Transportation Problem**	**4 hours**

Introduction - Formulation - Solution of the transportation problem (Min and Max): Northwest Corner rule, row minima method, column minima method, Least cost method, Vogel's approximation method – Optimality test: MODI method.

Module: 3	**Assignment and Sequencing Models**	**3 hours**

Assignment problems – Applications - Minimization and Maximization; Sequencing - Problem with N jobs and 2 machines – n jobs and 3 machines problem - n jobs and m machines problem.

Module: 4	**Project Management**	**4 hours**

Introduction - Phases of project management-Construction of Network diagrams- Critical path method (CPM) and Project evaluation and review technique (PERT) - Crashing of project network.

Module: 5	**Inventory Control**	**4 hours**

Necessity for maintaining inventory - Inventory costs -Inventory models with deterministic demand - inventory models with probabilistic demand - Inventory models with price breaks - Buffer stock.

Module: 6	**Queuing Models**	**4 hours**

Poisson arrivals and Exponential service times – Single channel models and Multi-channel models - Simulation: Basic concepts, Advantages and disadvantages - Random number generation - Monte Carlo Simulation applied to queuing problems.

Module: 7	Design of structures	5 hours
Game theory: Competitive games - Useful terminology - Rules for game theory - Two person zero sum game – Property of dominance - Graphic solution – Algebraic method. **Replacement models:** Replacement of items that deteriorate with time: No changes in the value of money, changes in the value of money - Items that fail completely: Individual replacement and group replacement policies.		
Module: 8	**Contemporary issues**	**2 hours**
Total Lecture hours		**30 hours**
Tutorial • A minimum of 3 problems to be worked out by students in every tutorial class. • 5 problems to be given as homework per tutorial class. • At least one open ended design problem to be given.		
Tutorial Class for Module 1 Tutorial Class for Module 2 Tutorial Class for Module 3 Tutorial Class for Module 4 Tutorial Class for Module 5 Tutorial Class for Module 6 Tutorial Class for Module 7 # A minimum of 3 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.		**30 hours**

Text Book (s)

1. Hamdy A Taha, Operations Research: An Introduction, 9th edition, Pearson Education, Inc., (2014)

Reference Books

1. Hira D S and Gupta P K, Operations Research, Revised edition, S. Chand & Sons, (2014).
2. Kanti Swarup, Gupta P.K., and Man Mohan, Operations Research, 18th edition, S. Chand & Sons, (2015).
3. Manohar Mahajan, Operations Research, Dhanpat Rai & Co., (2013).

Mode of Evaluation: Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test

Recommended by Board of Studies	17.08.2017		
Approved by Academic Council	47th ACM	**Date**	05.10.2017