GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University)

VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A++ Grade

GITAM School of Technology

CURRICULUM AND SYLLABUS

4 Year Undergraduate Programme
UCIVL01: B.Tech. Civil Engineering

w.e.f. 2023-24 Admitted Batch

(Updated on Nov 2024)

Academic Regulations

Applicable for the Undergraduate Programmes in the Schools of Business, Humanities & Social Sciences, Science, Technology

https://www.gitam.edu/academic-regulations

Vision

To become a global leader in higher education.

Mission

To impart futuristic and comprehensive education of global standards with a high sense of discipline and social relevance in a serene and invigorating environment.

Quality Policy

To achieve global standards and excellence in teaching, research, and consultancy by creating an environment in which the faculty and students share a passion for creating, sharing and applying knowledge to continuously improve the quality of education.

VISION AND MISSION OF THE SCHOOL

VISION

To become a global leader in holistic engineering education and research

MISSION

1. To impart a strong academic foundation and practical education through a flexible curriculum, state-of-the-art infrastructure, and best learning resources
2. To actively pursue academic and collaborative research with industries and research institutions, both in India and abroad
3. To build a congenial and innovative eco system by enabling the latest technologies, thus helping the students, to solve the challenges of societal importance
4. To provide our students with the appropriate leadership, management, communication skills and professional ethics for career success and to continuously impact the global lives

UCIVL01: B.Tech. Civil Engineering

(w.e.f. academic year 2023-24 admitted batch)

Programme Educational Objectives (PEOs)

PEO 1 Graduates will have strong foundation and understanding of the fundamental principles of mathematics, science, and engineering enabling graduates to pursue their careers as practicing civil engineers in civil and Allied Engineering fields

PEO 2 Graduates will have ability to pursue Post-Graduation and research in lifelong learning in the emerging and allied areas of Civil Engineering and Business

PEO 3 Graduates will be able to practice Civil Engineering in an ethical manner and implement eco- friendly sustainable technologies for the benefit of industry and society

PEO 4 Graduates will be able undertake consultancy services in contemporary areas to offer solutions to the technical challenges of the society

Mapping of the Mission of the School with the PEOs

	PEO1	**PEO2**	**PEO3**	**PEO4**
M1	H	M	M	H
M2	H	H	M	H
M3	M	H	H	H
M4	M	M	H	M

H – High, M – Medium, L – Low

Programme Outcomes(POs) and Programme Specific Outcomes(PSOs):

At the end of the Programme the students would be able to:

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12	Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1	Identify, formulate, and solve engineering problems to provide efficient solutions.
PSO2	Design and develop structural applications of varying complexities in emerging areas of Civil Engineering.
PSO3	Possess the subject knowledge and scientific temper necessary to engage in research with professional and ethical responsibility towards societal needs.

Curriculum Structure

(Flexible Credit System)

UNIVERSITY CORE (UC)								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
CSEN1001	1	IT Productivity Tools^	0	0	2	0	0	1*
CLAD1001	1	Emotional Intelligence & Reasoning Skills (Soft Skills 1)	0	0	2	0	0	1
CLAD1011	1	Leadership Skills & Quantitative Aptitude (Soft Skills 2)	0	0	2	0	0	1
CLAD1021	1	Verbal Ability & Quantitative Ability (Soft Skills 3)	0	0	2	0	0	1
CLAD1031	1	Practicing Verbal Ability & Quantitative Aptitude (Soft Skills 4)	0	0	2	0	0	1
CLAD20XX	2	Soft skills 5A/5B/5C	0	0	2	0	0	1
CLAD20XX	2	Soft skills 6A/6B/6C	0	0	2	0	0	1
DOSP10XX	1	Sports 1#	0	0	0	2	0	2*
DOSL10XX	1	Club Activity#	0	0	0	2	0	2*
DOSL10XX	1	Community Service#	0	0	0	0	2	2*
ENVS1001	1	Environmental Studies^	3	0	0	0	0	3*
FINA3001	3	Personal Financial Planning#	0	0	2	0	0	1*
LANG1012	1	Communication Skills In English – Intermediate	0	0	4	0	0	2
LANG1022	1	Communication Skills In English – Advanced	0	0	4	0	0	2
MFST1001	1	Health and Wellbeing#	0	0	2	0	0	1*
POLS1001	1	Indian Constitution and History	2	0	0	0	0	2*
PHPY1001	1	Gandhi for the 21st Century	2	0	0	0	0	2*
VEDC1001	1	Venture Development	0	0	0	2	0	2

* Pass/Fail courses
# Opt any two courses among the five
^ Online/Swayam/NPTEL Courses

Soft skills courses 5 and 6								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
CLAD2001	2	Preparation for Campus Placement-1 (Soft skills 5A)	0	0	2	0	0	1
CLAD2011	2	Preparation for Higher Education (GRE/ GMAT)-1 (Soft skills 5B)	0	0	2	0	0	1
CLAD2021	2	Preparation for CAT/ MAT – 1 (Soft skills 5C)	0	0	2	0	0	1
CLAD2031	2	Preparation for Campus Placement-2 (Soft skills 6A)	0	0	2	0	0	1
CLAD2041	2	Preparation for Higher Education (GRE/ GMAT)-2 (Soft skills 6B)	0	0	2	0	0	1
CLAD2051	2	Preparation for CAT/ MAT – 2 (Soft skills 6C)	0	0	2	0	0	1

Sports Courses								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
DOSP1001	1	Badminton	0	0	0	2	0	2
DOSP1011	1	Chess	0	0	0	2	0	2
DOSP1021	1	Carrom	0	0	0	2	0	2
DOSP1031	1	Football	0	0	0	2	0	2
DOSP1041	1	Volleyball	0	0	0	2	0	2
DOSP1051	1	Kabaddi	0	0	0	2	0	2
DOSP1061	1	Kho Kho	0	0	0	2	0	2
DOSP1071	1	Table Tennis	0	0	0	2	0	2
DOSP1081	1	Handball	0	0	0	2	0	2
DOSP1091	1	Basketball	0	0	0	2	0	2
DOSP1101	1	Tennis	0	0	0	2	0	2
DOSP1111	1	Throwball	0	0	0	2	0	2

Club Activity Courses								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
DOSL1001	1	Club Activity (Participant)	0	0	0	2	0	2
DOSL1011	1	Club Activity (Member of the Club)	0	0	0	2	0	2
DOSL1021	1	Club Activity (Leader of the Club)	0	0	0	2	0	2
DOSL1031	1	Club Activity (Competitor)	0	0	0	2	0	2

Community Service courses								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
DOSL1041	1	Community Services – Volunteer	0	0	0	0	2	2
DOSL1051	1	Community Services – Mobilizer	0	0	0	0	2	2

FACULTY CORE (FC)								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
CHEM1001	1	Chemistry	2	1	2	0	0	4
CSEN1011	1	Problem Solving and Programming with C	0	0	6	0	0	3
CSEN1021	1	Programming with Python	0	0	6	0	0	3
CSEN1031	1	Artificial Intelligence Applications	0	0	2	0	0	1
EECE1001	1	Basic Electrical and Electronics Engineering	2	1	2	0	0	4
HSMCH102	1	Universal Human Values	3	0	0	0	0	3
INTN2333	2	Internship 1	0	0	0	0	1	1
INTN3444	3	Internship 2	0	0	0	0	1	3
MATHXXXX	X	Mathematics Basket 1	2	0	0	0	0	2
MATHXXXX	X	Mathematics Basket 2	2	0	0	0	0	2
MATHXXXX	X	Mathematics Basket 3	2	0	0	0	0	2
MATHXXXX	X	Mathematics Basket 4	2	0	0	0	0	2
MATHXXXX	X	Mathematics Basket 5	2	0	0	0	0	2
MATHXXXX	X	Mathematics Basket 6	2	0	0	0	0	2
MATH2361	2	Probability and Statistics	3	0	0	0	0	3
MECH1011	1	Engineering Visualization and Product Realization	0	0	4	0	0	2
MECH1041	1	Technology Exploration & Product Engineering	0	0	4	0	0	2
MECH1001	1	Design Thinking	0	0	2	0	0	1
PHYS1001	1	Physics	2	1	2	0	0	4
PHYSXXXX	1	Physics Basket	3	1	0	0	0	4
PROJ2999	2	Capstone Project – Introduction	0	0	0	0	2	2
PROJ3999	3	Capstone Project – Final	0	0	0	0	6	6
PROJ2888	2	Project Exhibition 1	0	0	0	0	1	1
PROJ3888	3	Project Exhibition 2	0	0	0	0	1	1
VIVA3555	3	Comprehensive Examination	1	0	0	0	0	1
XXXXXXXX	X	Management Basket	3	0	0	0	0	3
BTEN1001	1	Introduction to Biotechnology-I	2	0	0	0	0	2
BTEN1021	1	Introduction to Biotechnology-II	2	0	0	0	0	2

Mathematics Basket								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
MATH1001	1	Single Variable Calculus	2	0	0	0	0	2
MATH1011	1	Several Variable Calculus	2	0	0	0	0	2
MATH2371	2	Difference Equations	2	0	0	0	0	2
MATH1031	1	Differential Equations	2	0	0	0	0	2
MATH2281	2	Numerical techniques	2	0	0	0	0	2
MATH1021	1	Transform Techniques	2	0	0	0	0	2
MATH2381	2	Operations Research	2	0	0	0	0	2
MATH2301	2	Complex Variables	2	0	0	0	0	2
MATH1041	1	Discrete Mathematics	2	0	0	0	0	2
MATH1051	1	Graph Theory	2	0	0	0	0	2
MATH2311	2	Number Theory	2	0	0	0	0	2
MATH2291	2	Linear Algebra	2	0	0	0	0	2
MATH2341	2	Probability Theory and Random Variables	2	0	0	0	0	2
MATH2321	2	Random Processes	2	0	0	0	0	2
MATH2351	2	Optimization Methods	2	0	0	0	0	2
MATH2331	2	Computational Methods	2	0	0	0	0	2
MATH1061	1	Introduction to Mathematics – I	2	0	0	0	0	2
MATH1071	1	Introduction to Mathematics – II	2	0	0	0	0	2
MATH2361	2	Probability and Statistics	3	0	0	0	0	3
Physics Basket								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
PHYS1001	1	Physics	2	1	2	0	0	4
PHYS1011	1	Mechanics and Properties of Matter	3	1	0	0	0	4
PHYS1021	1	Principles of Quantum Mechanics	3	1	0	0	0	4
PHYS1241	1	Physics of Optoelectronic devices	3	1	0	0	0	4
PHYS1041	1	Mechanics and Modern Physics	3	1	0	0	0	4
Management Basket								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
FINA1031	1	Principles and Practice of Banking	3	0	0	0	0	3
HRMG1021	1	Human Resource Management	3	0	0	0	0	3
MKTG3011	3	Sales and Distribution Management	3	0	0	0	0	3

Programme Core (PC)								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
CIVL2001	2	Architectural Planning and CAD Lab	1	0	2	0	0	2
CIVL2011	2	Principles of Mechanics	3	0	2	0	0	3
CIVL2021	2	Fluid Mechanics	3	0	2	0	0	4
CIVL2031	2	Surveying	3	0	2	0	0	4
CIVL2041	2	Mechanics of Solids	3	0	2	0	0	4
CIVL2051	2	Environmental Engineering	3	0	2	0	0	4
CIVL2061	2	Water Resources Engineering	3	0	0	0	0	3
CIVL2071	2	Construction Materials and Concrete Technology	2	0	2	0	0	3
CIVL2081	2	Geotechnical Engineering	3	0	2	0	0	4
CIVL2091	2	Structural Analysis	3	0	0	0	0	3
CIVL2101	2	Highway Engineering	3	0	2	0	0	4
CIVL2111	2	Estimation and Costing	3	0	0	0	0	3
CIVL2121	2	Advanced Surveying Techniques	0	0	4	0	0	2
CIVL2131	2	Computer Applications in Civil Engineering	0	0	6	0	0	3
CIVL3001	3	Design of Reinforced Concrete Structures	3	0	0	0	0	3
CIVL3011	3	Design of Steel Structures	3	0	0	0	0	3

Programme Elective (PE)								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
CIVL1001	1	Basics of Geographic Information Systems	3	0	0	0	0	3
CIVL1011	1	Principles of Building Planning – Vastu	3	0	0	0	0	3
CIVL1021	1	Sustainable Development and Management	3	0	0	0	0	3
CIVL2141	2	Repairs, Renovation and Rehabilitation of Structures	3	0	0	0	0	3
CIVL2151	2	Sustainable Materials	3	0	0	0	0	3
CIVL2161	2	Foundation Engineering	3	0	0	0	0	3
CIVL2171	2	Traffic Engineering	3	0	0	0	0	3
CIVL2181	2	Hydraulic Machines	3	0	0	0	0	3
CIVL2191	2	Waste Water Treatment	3	0	0	0	0	3
CIVL2201	2	Watershed Management	3	0	0	0	0	3
CIVL2211	2	Basics of Remote Sensing	3	0	0	0	0	3
CIVL2221	2	Advanced Structural Analysis	3	0	0	0	0	3
CIVL2231	2	Precast Concrete	3	0	0	0	0	3

CIVL2241	2	Rock Mechanics	3	0	0	0	0	3
CIVL2251	2	Pavement Analysis and Design	3	0	0	0	0	3
CIVL2261	2	Open Channel Hydraulics	3	0	0	0	0	3
CIVL2271	2	Pollution Prevention and Management	3	0	0	0	0	3
CIVL2281	2	Disaster Management	3	0	0	0	0	3
CIVL2291	2	Sustainable Management of Water and Environment	3	0	0	0	0	3
CIVL2301	2	Advanced Geographic Information Systems	3	0	0	0	0	3
CIVL2311	2	E-Waste Management	3	0	0	0	0	3
CIVL2321	2	Smart City Technologies	3	0	0	0	0	3
CIVL2331	2	Safety Engineering	3	0	0	0	0	3
CIVL2341	2	Construction Safety	3	0	0	0	0	3
CIVL2351	2	Computational Methods in Civil Engineering	2	0	2	0	0	3
CIVL2371	2	Planning of Infrastructure Projects	3	0	0	0	0	3
24CIVL3151	3	Remote sensing and Geographic Information System	3	0	0	0	0	3
CIVL3031	3	Advanced Reinforced Concrete Structures	3	0	0	0	0	3
CIVL3041	3	Analysis and Design of Structural Elements using Software	3	0	0	0	0	3
CIVL3051	3	Advanced Foundation Engineering	3	0	0	0	0	3
CIVL3061	3	Air Pollution and Its Control	3	0	0	0	0	3
CIVL3071	3	Construction Management	3	0	0	0	0	3
CIVL3081	3	Urban Transport Planning	3	0	0	0	0	3
CIVL3091	3	Advanced Design of Steel Structures	3	0	0	0	0	3
CIVL3101	3	Advanced Concrete Technology	3	0	0	0	0	3
CIVL3111	3	Ground Improvement Techniques	3	0	0	0	0	3
CIVL3121	3	Transportation Infrastructure Engineering	3	0	0	0	0	3
CIVL3131	3	Advanced Water Resources Engineering	3	0	0	0	0	3
CIVL3141	3	Environmental Impact Assessment	3	0	0	0	0	3
CIVL3151	3	Applications of GIS in Disaster Management	3	0	0	0	0	3
CIVL3161	3	Road Safety Management	3	0	0	0	0	3
CIVL3171	3	Prestressed Concrete	3	0	0	0	0	3
CIVL3181	3	Bridge Engineering	3	0	0	0	0	3
CIVL3191	3	Geosynthetics	3	0	0	0	0	3
CIVL3201	3	Road Safety Auditing	3	0	0	0	0	3
CIVL3211	3	Solid and Hazardous Waste Management	3	0	0	0	0	3
CIVL3221	3	Applications of GIS in Natural Resource	3	0	0	0	0	3

		Management						
CIVL3231	3	Applications of GIS in Urban Planning and Management	3	0	0	0	0	3
CIVL3251	3	Construction Contracts, Finance and Valuation	3	0	0	0	0	3

PROGRAMME STRUCTURE

BTech Programme consists of courses which could be grouped under University Core (UC), Faculty Core (FC), Major/Programme Core (PC), Major/Programme Electives (PE) and Open Electives (OE) as the below breakup.

Category	Credits	% of Program (in credits)
University Core (UC)	12	8%
Faculty Core (FC)	57	35%
Programme Core (PC)	52	33%
Programme Electives (PE)	15	9%
Open Electives (OE)	24	15%
Total	**160**	

Courses offered under University Core are common to all undergraduate level programmes offered by GITAM. Courses offered under Faculty core are common to all BTech programmes offered by GITAM and are meant to acquaint the student with general engineering principles in all disciplines of engineering. Based on the chosen BTech Programme, the student shall complete courses under Programme Core (specific to be chosen branch of engineering).

Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week. In general,

- **Theory:** A student attending classroom lecture/ tutorial/ skill development activity of 50 minutes' duration per week, spread over the entire semester is awarded one credit.
- **Practical:** A student attending a minimum of 100 minutes per week of laboratory session/practical is awarded - one credit.
- **Project Work:** A student working for 50 minutes of project work per week with 3 hours of work performed independent of the instructor during the entire semester is awarded - one credit
- **Internship:** 8 hours in a day for four weeks is required for earning internship credits

Course PO Mapping

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CIVL1021	Sustainable Development and Management	2	2	2		2	2	3	2	1	1		2	2	2	1
CIVL2001	Architectural Planning and CAD Lab	2	1	2	2	2	2	1	2	1	1	1	1	2	2	2
CIVL2011	Principles of Mechanics	2	3	3		3	1	2				2	2	2	2	2
CIVL2021	Fluid Mechanics	3	2	1	0	0	0	1	2	3	2	0	2	2	2	0
CIVL2031	Surveying	3	3			2	3			3	3		2	3	2	
CIVL2041	Mechanics of Solids	2	2	3	3		3					2		1	1	
CIVL2051	Environmental Engineering	2	2	2		2	2	3	2	1	1		2	2	2	1
CIVL2061	Water Resources Engineering	3	3	2	2		2	2		1			1	2	1	
CIVL2071	Construction Materials and Concrete Technology	3	2	2	1	2	1	1	1	2	2	0	3	1	3	2
CIVL2081	Geotechnical Engineering	3	3	2	2	2			3				1	2	2	2
CIVL2091	Structural Analysis	2	2	2	3		1					2		1	1	
CIVL2101	Highway Engineering	2	3	3	3	3	3			2	2	2	2	2	2	
CIVL2111	Estimation and Costing	2	2	3	2		3					2		1	1	
CIVL2121	Advanced Surveying Techniques	3	3	3		3				3	3			3	3	
CIVL2131	Computer Applications in Civil Engineering	2	2	2	2	2	2	2	1	1	1	1	1	2	2	2
CIVL3001	Design of Reinforced Concrete Structures	1	3	3		1	3	1	2		3		1	2	2	2
CIVL3011	Design of Steel Structures	2	3	3	2	1	3	1	2	1	1	1	1	2	2	2
CIVL1001	Basics of Geographic Information Systems	3	3	3		3				3	3			3	3	
CIVL1011	Principles of Building Planning – Vastu	2	1	2	2	2	2	1	2	1	1	1	1	2	2	2
CIVL2141	Repairs, Renovation and Rehabilitation of Structures	3	2	2	1		2	2				2	2	2	2	2
CIVL2151	Sustainable Materials	2	2	1	1	1	2	3	3	1	0	1	1	1	2	3

CIVL2161	Foundation Engineering	3	3	2	1	2							2	2	2	2
CIVL2171	Traffic Engineering	2	2		2					2			2	2	2	
CIVL2181	Hydraulic Machines	3	2	0	0	2	0	1	2	3	2	0	2	2	1	
CIVL2191	Waste Water Treatment	2	2	2	2	2	2	3	2	1	1		2	2	2	1
CIVL2201	Watershed Management	3	3	3			2	2		3			1	3		
CIVL2211	Basics of Remote Sensing	3	3			3	3			3	3		3	2	2	3
CIVL2221	Advanced Structural Analysis	2	2	2	3		1					2		1	1	
CIVL2231	Precast Concrete	2	2	2	1	1	2	1	2	0	0	1	1	2	2	3
CIVL2241	Rock Mechanics	2	2	1	1	1								1	2	1
CIVL2251	Pavement Analysis and Design	2	3	3	2	3	1							2	2	3
CIVL2261	Open Channel Hydraulics	3	3	1	1	2	0	1	2	3	2	0	2	3	1	
CIVL2271	Pollution Prevention and Management	2	2	2	2	2	2			2	2			2	2	2
CIVL2281	Disaster Management	3	3	2	2		2	2		1			1	2	1	
CIVL2291	Sustainable Management of Water and Environment	3	3	2	2		2	2		1			1	2	1	3
CIVL2301	Advanced Geographic Information Systems	3	3			3	3			3	3		3	2	2	3
CIVL2311	E-Waste Management	2	2	2		2	2	3	2	1	1		2	2	2	1
CIVL2321	Smart City Technologies	3	2		2	1	3	1		2	2	1	1	2	2	2
CIVL2331	Safety Engineering	3	3	2	2		2	2		1			1	2	1	3
CIVL2341	Construction Safety	2	2	2	1	3	2	0	0	2	0	1	1	2	2	0
CIVL2351	Computational Methods in Civil Engineering	3	3			3	3			3	3		3	2	2	3
CIVL2371	Planning of Infrastructure Projects	3	3			3	3			3	3		3	2	2	3

24CIVL3151	Remote Sensing and Geographic Information Systems	3	3			3	3			3	3		3	2	2	3
CIVL3031	Advanced Reinforced Concrete Structures	3	3	2	2	1	1	0	3	1	0	1	2	3	3	3
CIVL3041	Analysis and Design of Structural Elements using Software	2	2	2	1	3	2	0	0	2	0	1	1	2	2	0
CIVL3051	Advanced Foundation Engineering	3	3	2		2	2	1		2			2	2	2	2
CIVL3061	Air Pollution and Its Control	2	2	2	2	2	2			2	2			2	2	2
CIVL3071	Construction Management	2	3	2	2	3		2						2	3	2
CIVL3081	Urban Transport Planning	2	2	2	2	2	2			2	2			2	2	
CIVL3091	Advanced Design of Steel Structures	2	2	3	3	1	2	2	2	2	1	1	1	3	3	2
CIVL3101	Advanced Concrete Technology	2	2	1	2	2	1	1	1	1	0	0	1	2	2	2
CIVL3111	Ground Improvement Techniques	1	2	2	1	2	1	1				1	2	1	1	2
CIVL3121	Transportation Infrastructure Engineering	3	2		2	1	3	1		2	2	1	1	2	2	2
CIVL3131	Advanced Water Resources Engineering	3	3	3			2	2		3			1	3		
CIVL3141	Environmental Impact Assessment	2	2	2	0	0	1	3	1	1	0	0	2	2	2	1
CIVL3151	Applications of GIS in Disaster Management	3	3	2	2		2	2		1			1	2	1	3
CIVL3161	Road Safety Management	2	2		2					2			2	2	2	2
CIVL3171	Prestressed Concrete	3	3	3	1	0	1	0	3	1	0	0	2	3	2	2
CIVL3181	Bridge Engineering	2	2	2	2	2	0	0	1	1	0	1	0	3	2	2
CIVL3191	Geosynthetics	2	2	1	2			2						2	2	2
CIVL3201	Road Safety Auditing	2	2	2	2	2	2			2	2			2	2	2
CIVL3211	Solid and Hazardous Waste Management	2	2	2	0	0	1	3	1	1	0	0	2	2	2	1

CIVL3221	Applications of GIS in Natural Resource Management	3	3	2	2		2	2		1			1	2	1	
CIVL3231	Applications of GIS in Urban Planning and Management	3	3	2	2		2	2		1			1	2	1	3
CIVL3251	Construction Contracts, Finance and Valuation	**3**	**3**	**2**	**2**		**2**	**2**		**1**			**1**	**2**	**1**	

Syllabus

University Core

CSEN1001	IT Productivity Tools	L	T	P	S	J	C
		0	0	2	0	0	1*
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	Familiarity with Computer system and its operation.						

Course Description:

This course introduces all software tools that improve the productivity of a student in enhancing his learning experience with all the activities taken up as part of his coursework.

Course Educational Objectives:

- To enable the learner, the skill in preparing technical documents of professional quality using docs, sheets and forms.
- To involve the student in designing and creating of websites and acquaint the student with the skill of processing audio, images, documents etc.
- To create awareness in analyzing data using pivot tables, query manager etc.
- To create awareness in composing emails, mail merge, e-mail merge etc.
- To provide the exposure to work with collaborative tools.

List of Experiments:

1. Create a typical document consisting of text, tables, pictures, multiple columns, with different page orientations.
2. Create a technical paper / technical report consisting of table of contents, table of figures,table of tables, bibliography, index, etc.
3. Compose and send customized mail / e-mail using mail-merge.
4. Create / modify a power point presentation with text, multimedia using templates withanimation.
5. Create spreadsheet with basic calculations with relative reference, absolute reference, andmixed reference methods.
6. Simple report preparation using filtering tool / advanced filtering commands / pivot tables in spreadsheet application.
7. Analyse the results of a examination student wise, teacher wise, course wise, institute-wise.
8. Collecting and consolidating data using collaborative tools like google docs, sheets, forms.
9. Create charts / pictures using online tools like: www.draw.io or smart draw
10. Create a website of his interest.

Textbooks:

1. Katherin Murray, 'Microsoft Office 365 Connect and collaborate virtually anywhere, anytime', Microsoft Press, ISBN: 978-0-7356-5694-9
2. EXCEL 2021 The Comprehensive Beginners to Advanced Users Guide to Master Microsoft Excel 2021. Learn the Essential Functions, New Features, Formulas, Tips and Tricks, and Many More
3. https://drawio-app.com/tutorials/video-tutorials/
4. Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and WebGraphics Fourth Edition ISBN-13: 978-1449319274

References/Online Resources:

1. https://www.coursera.org/learn/introduction-to-computers-and-office-productivity-software
2. https://www.coursera.org/projects/analyze-data-pivot-tables-crosstabs-google-sheets
3. https://www.coursera.org/learn/excel-advanced#syllabus
4. https://www.coursera.org/learn/how-to-create-a-website
5. https://support.microsoft.com/en-us/office
6. https://www.diagrams.net/
7. https://edu.google.com/

Course Outcomes:

1. Create / alter documents / Technical Paper / Project report with text, pictures, graphs ofdifferent styles.
2. Create / modify power point presentations with text, multimedia and to add animationusing / creating templates.
3. Perform basic calculations / retrieve data / createpivot tables / chart using a spreadsheetapplication.
4. Create simple diagrams / charts using online tools like: www.draw.io .
5. Manage documents, presentations, spreadsheets and websites in collaborative mode.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS12	PSO1	PSO2	PSO3
CO1					2				1	1					
CO2					2				1	1					
CO3	2	1	1		2				1	1					
CO4					2				1	1					
CO5					2				3	3					

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : September 6, 2021

ACADEMIC COUNCIL: 21st AC(September 17, 2021

SDG No. & Statement: 4 Quality Education

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

The students can perform simple document preparation to complex calculations in isolated mode and collaborative mode that are useful throughout their career.

<table>
<tr><td rowspan="2">CLAD1001</td><td rowspan="2">EMOTIONAL INTELLIGENCE & REASONING SKILLS (SOFT SKILLS 1)</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">None</td></tr>
<tr><td>Co-requisite</td><td colspan="7">None</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">None</td></tr>
</table>

Course Description:

Emotional intelligence is a set of skills that are thought to contribute to the appraisal of emotions in oneself and others. It can also help contribute to the effective regulation of emotions as well as feelings (Salovey & Mayer, 1990). In terms of emotional intelligence, self-awareness and self- management have to do with our ability to relate to ourselves. Social awareness and relationship management have to do with our ability to relate to others. Similarly, the ability to solve questions on Analytical Reasoning and Data Sufficiency is a critical area tested in almost all competitive examinations and admission tests. Upon completion, students should be able (1) to deal with theirown emotions as well as the emotions of others and relate better with both. Using better knowledgeof EI, students will also be able to set more meaningful goals for themselves, choose suitable time management techniques that work best for them and work in teams more effectively. (2) to apply different concepts, ideas, and methods to solve questions in reasoning and data sufficiency

Course Educational Objectives:

- Use EI to relate more effectively to themselves, their colleagues and to others. Apply self-awareness and self-assessment (SWOT) to better understand and manage their own emotions. Apply social awareness to empathize with others and build stronger relationships with others.
- Set meaningful goals based on their strengths and weaknesses and apply time management techniques, such as Q4 organizing to put first things first.
- Manage conflicts and work in teams in an emotionally intelligent manner.
- Solve questions on non-verbal and analytical reasoning, data sufficiency and puzzles

List of Activities & Tasks for Assessment:

Unit	Topics	Hours
1	Self-Awareness & Self-Regulation: Introduction to Emotional Intelligence, *Self-Awareness:* Self-Motivation, Accurate Self-Assessment (SWOT Analysis),Self-Regulation: *Self Control, Trustworthiness & Adaptability*	3
2	Importance, Practising Social Awareness, Building Relationships, Healthy andUnhealthy Relationships, Relationship Management Competencies-Influence, Empathy, Communication, Types of Conflicts, Causes, Conflict Management	3

3	Social Media: Creating a blog, use of messaging applications, creating awebsite to showcase individual talent, creation of a LinkedIn Profile	2
4	Goal Setting & Time Management: Setting SMART Goals, Time Wasters, Prioritization, Urgent Vs Important, Q2 Organization	3
5	Teamwork: Team Spirit, Difference Between Effective and Ineffective Teams, Characteristics of High Performance Teams, Team Bonding, Persuasion, Team Culture, Building Trust, Emotional Bank Account	4
6	Verbal Reasoning: Introduction, Coding-decoding, Blood relations, Ranking Directions, Group Reasoning	6
7	Analytical Reasoning: Cubes and Dices, Counting of Geometrical figures	3
8	Logical Deduction: Venn diagrams, Syllogisms, Data Sufficiency, Binary logic	4
9	Spatial Reasoning: Shapes, Paper Cutting/Folding, Mirror images, Water images and Rotation of figures	2

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Students will be able to relate more effectively to themselves, their colleagues and to others
2. Students will be able to set their short term and long term goals and better manage their time
3. Students will be able to manage conflicts in an emotionally intelligent manner and work inteams effectively
4. Students will be able to solve questions based on non-verbal and analytical reasoning, datasufficiency and puzzle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									3	3		2			
CO2	2	2	2	3	2	1	2		3	3		3			
CO3	2		2	3					3	2	2	2			
CO4	2	2	2	3		1					2	3			
CO5															

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-201**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Emotional Intelligence and reasoning skills are essential for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD1011	LEADERSHIP SKILLS & QUANTITATIVE APTITUDE (SOFT SKILLS 2)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Communication Skills is having the ability to convey information to others so that messages are understood, and outcomes delivered. Some essential qualities of Communication Skills include understanding the needs of others, clearly communicating messages, adapting the communication style, and using a range of communication methods. Presentation Skills is having the ability to confidently deliver an engaging messageto a group of people which achieves the objectives. Some essential qualities of Presentation Skills include a thorough preparation of content, structuring content logically, managing nerves, engaging your audience, delivering presentation objectives, positively influencing the audience, and responding to audience needs.Tackling questions based on numbers, arithmetic, data interpretation and puzzles requires the application of different rules and concepts of numerical computation, numerical estimation, and data estimation.

Course Educational Objectives:

- Learn and apply, through different individual and group activities, different ideas, and skills tocommunicate in a positive and impressive manner.
- Apply the goal setting process (based on SWOT) and Q2 organizing for effective time management.
- Apply different concepts in numbers, numerical computation, and numerical estimation to solvequestions that often appear in various competitive examinations and admission tests.
- Apply different concepts for tackling questions based on data interpretation, progression and series thatare frequently given in various competitive examinations and admission tests.

List of Activities & Tasks for Assessment:

Unit	Topics	Hours
1	Communication Skills: The Communication Process, Elements of Interpersonal Communication, Non-Verbal Communication: Body Language, Posture, Eye Contact, Smile, Tone of Voice, Barriers to Communication. Effective Listening Skills: Active Listening, Passive	5

	Listening, Asking Questions, Empathizing, Being Non-Judgmental, Being Open Minded, Mass Communication: Design of Posters, Advertisements, notices, writing formal and informal invitations	
2	Focus on Audience Needs, focus on the Core Message, Use Body Language andVoice, Start Strongly, Organizing Ideas & Using Visual Aids: SPAM Model, EffectiveOpening and Closing Techniques, Guy Kawasaki's Rule (10-20-30 Rule), Overcoming Stage Fear, Story Telling	3
3	Problem Solving & Decision Making: Difference Between the Two, Steps in RationalApproach to Problem Solving: Defining the Problem, Identifying the Root Causes, Generating Alternative Solutions, Evaluating and Selecting Solutions, Implementingand Following-Up, Case Studies	3
4	Group Discussion: Understanding GD, Evaluation Criteria, Nine Essential Qualities for Success, Positive and Negative Roles, Mind Mapping, structuring a Response, Methods of Generating Fresh Ideas	4
5	Number Theory: Number System, Divisibility rules, Remainders and LCM & HCF	3
6	Numerical Computation and Estimation - I: Chain Rule, Ratio Proportions, Partnerships & Averages, Percentages, Profit-Loss & Discounts, Mixtures, Problem on Numbers & ages	6
7	Data Interpretation: Interpretation and analysis of data in Tables, Caselets, Line- graphs, Pie-graphs, Boxplots, Scatterplots and Data Sufficiency	3
8	Mental Ability: Series (Number, Letter and Alphanumeric), Analogy (Number, Letter and Alphanumeric) and Classifications	3

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Students will be able to communicate 'one-on-one' and 'one-on-many' confidently using both verbal and non-verbal messages and deliver impressive talks/ presentations to a group both with and without the use of PPTs and create posters, advertisements, etc.
2. Students will be able to apply the rational model of problem solving and decision makingin their problem solving and decision-making efforts.

3. Students will be able to solve questions based on numbers and arithmetic given in various competitive examinations
4. Students will be able to solve questions based on data interpretation, progressions, and series.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						2			2	3		2			
CO2	2	2	3	2		3	3		3	3		2			
CO3	2	2	2	2		2						3			
CO4	2	2	2	2		2									
CO5															

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Leadership and quantitative aptitude skills are essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

<table>
<tr><td rowspan="2">CLAD1021</td><td rowspan="2">VERBAL ABILITY & QUANTITATIVE ABILITY
(SOFT SKILLS 3)</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">None</td></tr>
<tr><td>Co-requisite</td><td colspan="7">None</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">None</td></tr>
</table>

Course Description:

Vocabulary is an important part of verbal ability. An understanding of word formation, prefixes, suffixes, and roots is necessary to remember and use a vast repository of words. Approaching words through word families and other ways of groupings is an effective way of gaining mastery over vocabulary. Understanding and getting acquainted with the different rules and exceptions in the use of grammar and structure, especially from the relevant examination point of view, is crucial to cracking questions given in many competitive tests. Similarly, improving reading comprehension skills and test taking abilities in this area takes time and effort, especially given the fact that most students do not possess strong reading habits. In so far as quantitative aptitude is concerned, students need to develop a strong foundation on the basic mathematical concepts of numerical estimation, geometry, mensuration, data sufficiency, etc. to be able to crack different round 1 tests of major recruiters and admission tests of top Indian and foreign universities.

Course Educational Objectives:

- List and discuss the different word formation methods, word denotation, connotation, collocation, etc. and introduce selected high frequency words, their antonyms, synonyms, etc.
- Apply different advanced reading skills to solve questions based on author's tone, main ideas and sub-ideas, inferences, Para jumbles, etc. that are frequently asked in various competitive exams and admission tests.
- Solve different types of questions based on vocabulary, such as word analogy; structure, grammar, and verbal reasoning; introduce common errors and their detection and correction.
- Solve questions on numerical estimation, mensuration, data sufficiency based on quantitative aptitude. This includes questions on time and work, time and distance, pipes and cisterns, lines and angles, triangles, quadrilaterals, polygons and circles, 2- & 3-dimensional mensuration.

List of Activities & Tasks for Assessment:

1. **Vocabulary Builder:** Understanding Word Formation, Prefixes, Suffixes and Roots, Etymology, Word Denotation, Connotation and Collocation, Synonyms and Antonyms

2. **Reading Comprehension:** Advanced Reading Comprehension: Types of RC passages, Types of Text Structures, Types of RC Questions: Distinguishing Between Major Ideas and Sub Ideas, Identifying the Tone and Purpose of the Author, Reading Between the Lines and Beyond the Lines, Techniques for Answering Different Types of Questions
3. **Para Jumbles:** Coherence and Cohesion, Idea Organization Styles, Concept of Mandatory Pairs and Its Application: Transitional Words, Antecedent-Pronoun Reference, Article Reference, Cause and Effect, Chronological Order, General to Specify, Specify to General, Idea-Example, Idea-Explanation, Etc.
4. **Grammar Usage:** Rules Governing the Usage of Nouns, Pronouns, Adjectives, Adverbs, Conjunctions, Prepositions and Articles
5. **Numerical Computation and Estimation - II:** Time and Work, Pipes and Cisterns, Time and Distance, Problems on Trains, Boats and Streams, Races and Games of Skill, Simple Interest& Compound Interest
6. **Geometry:** Lines and Angles, Triangles, Quadrilaterals & Polygons, and Circles
7. **Mensuration:** 2-Dimensional Mensuration (Triangles, Quadrilaterals and Circles), 3-Dimensional Mensuration (Cubes, Cuboids, Cylinder, Cone, Sphere)

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. List and discuss word formation methods, selected high frequency words, their antonyms, synonyms, etc.
2. Analyze reading passages and quickly find out the correct responses to questions asked, including para jumbles, by using reading skills like skimming, scanning, reading between the lines, etc.
3. Solve different types of questions based on vocabulary, structure, grammar and verbal reasoning
4. Solve questions on numerical estimation, mensuration, data sufficiency based on quantitative aptitude

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									1	3		2			
CO2				2		2				2		3			
CO3									1	2		3			
CO4	2	2	3			2						1			
CO5															

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

English language and quantitative aptitude skills are essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD1031	PRACTICING VERBAL ABILITY & QUANTITATIVE APTITUDE (SOFT SKILLS 4)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

A sound knowledge of the rules of English grammar, structure and style and its application in detecting errors in writing are important areas of Verbal Ability frequently tested as a part of the written test in many competitive examinations and admission tests of major recruiters and universities respectively. This module focuses on all important areas of grammar and structure commonly asked in major tests, such as GMAT, CAT, XLRI, CRT, etc. Similarly, in the area of Quantitative Aptitude, different kinds of questions are asked from Combinatorics (Permutations & Combinations, Probability], Cryptarithmetic & Modular Arithmetic (Cryptarithmetic, Application of base system (7, 24), Clocks (Base 24), Calendars (Base 7), and Mental Ability (Number series, Letter series & Alpha numeric series, Analogies (Numbers, letters), Classifications, Algebra (Exponents, Logarithms, Problems related to Equations, Special Equations, and Statistics) . This module focuses on all these areas by building on what the students already learnt in their earlier studies.

Course Educational Objectives:

- Apply the rules of grammar to solve questions in Error Detection, Sentence Correction and Sentence Improvement.
- Apply the rules of structure to solve questions in Error Detection, Sentence Correction and Sentence Improvement, Fill-in-blanks and Cloze Passages.
- Explain methods of solving problems in Combinatorics (Permutations & Combinations, Probability], Cryptarithmetic & Modular Arithmetic (Cryptarithmetic, Application of basesystem (7, 24), Clocks (Base 24), Calendars (Base 7)]
- Explain how to solve questions in Mental Ability (Number series, Letter series & Alpha numeric series, Analogies, Numbers, letters, Classifications] and Algebra (Exponents, Logarithms, Problems related to Equations, Special Equations, Statistics)

List of Activities & Tasks for Assessment:

1. Error Detection: Pronouns, Conjunctions, Prepositions and Articles
2. Error Detection: Tenses and their Uses
3. Sentence Correction: Subject-Verb Agreement, Antecedent-Pronoun Agreement, Conditional Clauses
4. Sentence Correction: Modifiers (Misplaced and Dangling) & Determiners, Parallelism & WordOrder, and Degrees of Comparison
5. Combinatorics: Permutations & Combinations, Probability

6. Crypt arithmetic & Modular Arithmetic: Crypt arithmetic, Application of Base System (7, 24),Clocks (Base 24), Calendars (Base 7)
7. Algebra: Exponents, Logarithms, Word-problems related to equations, Special Equations,Progressions, Statistics

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Identify and correct errors in English grammar and sentence construction
2. Identify and correct errors in Structure, Style and Composition
3. Solve problems in Combinatorics, Cryptarithmetic, and Modular Arithmetic
4. Solve problems in Mental Ability and Algebra

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									1	3		1			
CO2									1	3		1			
CO3		2	3	2		2						2			
CO4		3	2	2		2						2			
CO5															

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

English language and quantitative aptitude skills are essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2001	PREPARATION FOR CAMPUS PLACMENT -1 (SOFT SKILLS 5A)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course addresses all relevant areas related to campus placements and readies them to ace their upcoming/ ongoing recruitment drives. Specifically, it focuses on students' career preparedness, interview skills, test preparedness, etc.

Course Educational Objectives:

Prepare the students for their upcoming/ ongoing campus recruitment drives.

List of Activities & Tasks for Assessment:

1. Career Preparedness: Resume & Cover Letter Writing, Interview Skills: Elevator Pitch, Making the First Impression, Being Other-Oriented, Being Positive and Curious, communicating with Confidence and Poise, Frequently Asked Questions & How to Answer Them, Pitfalls to Avoid, Etc. Etiquette: Hygiene, Courtesy, Culture differences, Workplace, use of cell phone, Profanity, Slang, Protocol.
2. Verbal Ability: Practicing Reading Comprehension, Error Detection, Sentence Completion, MCQs, FIBs, Para jumbles, Cloze Test, Critical Reasoning.
3. Quantitative Aptitude: Number Systems, Algebra, Geometry, Data Handling, Data Sufficiency, Word Problems
4. Reasoning: Logical and Verbal Reasoning

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and MeenakshiUpadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMSetc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Write a power resume and covering letter
2. Answer interview questions with confidence and poise
3. Exhibit appropriate social mannerisms in interviews
4. Solve placement test questions on verbal ability, quantitative aptitude and reasoning

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									3	2		1			
CO2						3			2			1			
CO3						2			1	3		3			
CO4		3		2		2			1			3			
CO5															

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for campus placement tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2011	PREPARATION FOR HIGHER EDUCATION (GRE/ GMAT)-1 (SOFT SKILLS 5B)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course offers a special track for students who aspire to go abroad in pursuit of their higher education for which a GRE/ GMAT score is a prerequisite. It covers all four topical areas of these tests and includes fully solved mock tests as well.

Course Educational Objectives:

- Prepare the students to solve questions from all four broad areas of GRE/ GMAT
- Orient the students for GRE/ GMAT through mock tests

List of Activities & Tasks for Assessment:

1. Verbal Reasoning: Reading Comprehension, Sentence Equivalence, TextCompletion, Sentence Correction, Critical Reasoning
2. Quantitative Reasoning: Arithmetic, Algebra, Geometry, Data Analysis
3. Analytical Writing Assessment: Issue/ Argument
4. Integrated Reasoning

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and MeenakshiUpadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMSetc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Solve questions from all four broad areas of GRE/ GMAT
2. Practice answering several mock tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	2	2					3			3			
CO2		2	2	2					3			3			
CO3															
CO4															
CO5															

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for GRE/GMAT tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2021	PREPARATION FOR CAT/ MAT – 1 (SOFT SKILLS 5C)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course offers a special track for UG students who aspire to go for higher education in business management in India for which cracking CAT/ MAT/ other related test is mandatory. It covers all four topical areas of these tests and includes fully solved mock testsas well.

Course Educational Objectives:

- Prepare the students to solve questions from all four relevant areas of CAT/ XAT/MAT, etc.
- Orient the students for CAT/ XAT, etc. through mock tests

List of Activities & Tasks for Assessment:

1. Quantitative Ability: Arithmetic, Algebra, Geometry, Mensuration, Calculus, Trigonometry
2. Data Interpretation: Data Interpretation and Data Sufficiency
3. Logical Reasoning: Data Management, Deductions, Verbal Reasoning and Non-Verbal Reasoning
4. Verbal Ability: Critical Reasoning, Sentence Correction, Para Completion, Para Jumbles, Reading Comprehension

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher andIMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Solve questions from all four relevant areas of CAT/ MAT as listed above
2. Practice test-cracking techniques through relevant mock tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2		2			3	3	3	3			
CO2	2	2	2	2		1			2		2	3			
CO3															
CO4															
CO5															

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for CAT/ MAT tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2031	PREPARATION FOR CAMPUS PLACEMENT-2 (SOFT SKILLS 6A)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course builds on the previous course and focuses on all four major areas of campus placements, including career preparedness, mock interviews, verbal ability, quantitative aptitude, and logical reasoning.

Course Educational Objectives:

- To comprehensively prepare all eligible and aspiring students for landing their dream jobs.
- To sharpen the test-taking skills in all four major areas of all campus drives

List of Activities & Tasks for Assessment:

1. Career Preparedness II: Mock Interviews, Feedback and Placement Readiness
2. Verbal Ability II: Practising Reading Comprehension, Error Detection, Sentence Completion, MCQs, FIBs, Para jumbles, Cloze Test, Critical Reasoning
3. Quantitative Aptitude II: Number Systems, Algebra, Geometry, Data Handling,Data Sufficiency, Word Problems
4. Reasoning II: Logical and Verbal Reasoning

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMSetc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Demonstrate career preparedness and confidence in tackling campus interviews
2. Solve placement test questions of a higher difficulty level in verbal ability, quantitative aptitude and logical reasoning.
3. Practice test-taking skills by solving relevant questions accurately and within time.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									2	3		2			
CO2	2	2	2	3		3			2	2	3	2			
CO3	2	2	2	3		2			1		2	3			
CO4															
CO5															

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for campus placement tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2041	PREPARATION FOR HIGHER EDUCATION (GRE/GMAT)-2 (SOFT SKILLS 6B)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course offers a special track for students who aspire to go abroad in pursuit of theirhigher education for which a GRE/ GMAT score is a prerequisite. It covers all four topical areas of these tests at a higher difficulty-level and includes fully solved mock tests as well.

Course Educational Objectives:

- Prepare the students to solve higher level questions from all four broad areas of GRE/ GMAT
- Orient the students for GRE/ GMAT through mock tests

List of Activities & Tasks for Assessment:

1. Verbal Reasoning II: Reading Comprehension, Sentence Equivalence, Text Completion, Sentence Correction, Critical Reasoning
2. Quantitative Reasoning II: Arithmetic, Algebra, Geometry, Data Analysis
3. Analytical Writing Assessment II: Issue/ Argument
4. Integrated Reasoning II

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and MeenakshiUpadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMSetc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Solve higher level questions from all four broad areas of GRE/ GMAT
2. Practice answering several mock tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		3		2			2	2	2	2			
CO2		2		2		2			2	2	2	2			
CO3															
CO4															
CO5															

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for GRE/GMAT tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2051	PREPARATION FOR CAT/ MAT – 2 (SOFT SKILLS 6C)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course offers a special track for UG students who aspire to go for higher education in business management in India for which cracking CAT/ MAT/ other related test is mandatory. It covers all four topical areas of these tests at a higher level of difficulty and includes fully solved mock tests as well.

Course Educational Objectives:

- Prepare the students to solve all types of questions from all four relevant areas of CAT/ XAT/ MAT, etc.

List of Activities & Tasks for Assessment:

1. Quantitative Ability II: Arithmetic, Algebra, Geometry, Mensuration, Calculus, Trigonometry
2. Data Interpretation II: Data Interpretation and Data Sufficiency
3. Logical Reasoning II: Data Management, Deductions, Verbal Reasoning and Non-Verbal Reasoning
4. Verbal Ability II: Critical Reasoning, Sentence Correction, Para Completion, Para Jumbles, Reading Comprehension

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and MeenakshiUpadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMSetc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Solve higher difficulty level questions from all four relevant areas of CAT/ MAT aslisted above
2. Practice test-cracking techniques through relevant mock tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3		3					3	3	3	2			
CO2	1	2		2					2	3	2	2			
CO3															
CO4															
CO5															

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for CAT/ MAT tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

DOSL1001	CLUB ACTIVITY – PARTICIPANT	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course recognizes student participation in multiple activities organized by various student organizations that pursue specific co-curricular and extra-curricular interests. These activities allow students to engage in and identify and pursue their personal interests and hobbies.

Course Educational Objectives:

- Create opportunities for students to participate in a variety of non-academic experiences
- Interact with and learn from peers in a setting without an external performance pressure
- Allow exploration of interesting activities and reflection about these experiences
- Learn to manage time effectively

List of Student Club Activities:

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc)
5. Craft (origami, model making, sculpture, pottery, etc)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multi media, etc)
8. Workshops, quizzes, debates, elocution, etc
9. Filmmaking (adventure, drama, film appreciation, documentary, etc)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities:

1. Participation in various club-based activities
2. Weekly reflection paper
3. Portfolio (on social media using an Instagram account)
4. Two learning papers (one per semester)

Textbooks:

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References:

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. YouTube- Introduction to various club activities

Course Outcomes:

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

1. Identify personal interest areas
2. Learn from diverse perspectives and experiences
3. Gain exposure to various activities and opportunities for extra-curicular activities
4. Learn to manage time effectively
5. gain confidence

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	3	2	3	2			
CO2									3	3		2			
CO3									3	3	2	3			
CO4									3	3		3			
CO5								3	3	3		2			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

This course recognizes student participation in non-academic events and activities which focus on inclusive partnerships and collaborations with all stakeholders by using all sustainable means to promote lifelong learning.

DOSL1011	CLUB ACTIVITY – MEMBER OF THE CLUB	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course encourages and acknowledges student members' work in organizing events and activities organized by various student organizations that pursue specific co-curricular and extra- curricular interests. These activities allow students to actively learn from the process of conceptualizing and organizing such activities as part of a team.

Course Educational Objectives:

- Create opportunities for students to learn from organizing club activities
- Learn teamwork, leadership, planning and management of events and activities
- Learn to appreciate multiple perspectives, cultures, and individual capabilities
- Learn to manage time effectively

List of Student Club Activities:

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc)
5. Craft (origami, model making, sculpture, pottery, etc)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multi media, etc)
8. Workshops, quizzes, debates, elocution, etc
9. Filmmaking (adventure, drama, film appreciation, documentary, etc)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities:

1. Be a member of a club and organize activities in that particular interest area
2. Learn from diverse perspectives and experiences
3. Learn to design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

Textbooks:

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References:

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. Youtube- Introduction to various club activities

Course Outcomes:

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

- Be a member of a club and organize activities in that particular interest area
- Learn from diverse perspectives and experiences
- Learn to design and execute extra-curricular activities
- Develop management skills through hands on experience
- Explore different managerial roles and develop competencies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	3	3		3			
CO2									3	2		3			
CO3								3	3	2					
CO4										2	3	3			
CO5								2				3			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

		L	T	P	S	J	C
DOSL1021	**CLUB ACTIVITY – LEADER OF THE CLUB**	**0**	**0**	**0**	**2**	**0**	**2**
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course encourages and recognizes student members' work in leading the student organizationsthrough various leadership roles. As leaders they work not just to organize events and activities in specific co-curricular and extra-curricular interests, but also lead the teams that form the core members of the clubs. These activities allow students to learn and practice leadership and management skills through real world experience.

Course Educational Objectives:

- Create opportunities for students to learn from organizing club activities
- Learn teamwork, leadership, planning and management of events and activities
- Learn to appreciate multiple perspectives, cultures, and individual capabilities
- Learn to manage time effectively

List of Student Club Activities:

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc)
5. Craft (origami, model making, sculpture, pottery, etc)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multimedia, etc)
8. Workshops, quizzes, debates, elocution, etc
9. Filmmaking (adventure, drama, film appreciation, documentary, etc)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities:

1. Be the leader of the club and implement the charter, vision and mission of the club
2. Learn from diverse perspectives and experiences
3. Learn to lead the team, design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

Textbooks:

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students(Cal Newport)

References:

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. Youtube- Introduction to various club activities

Course Outcomes:

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

- Be the leader of the club and implement the charter, vision and mission of the club
- Learn from diverse perspectives and experiences
- Learn to lead the team, design and execute extra-curricular activities
- Develop management skills through hands on experience
- Explore different managerial roles and develop competencies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	3	3		3			
CO2									3	2		3			
CO3								3	3	2					
CO4										2	3	3			
CO5								2				3			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

<table>
<tr><td rowspan="2">DOSL1031</td><td rowspan="2">CLUB ACTIVITY – COMPETITOR</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>2</td><td>0</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">None</td></tr>
<tr><td>Co-requisite</td><td colspan="7">None</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">None</td></tr>
</table>

Course Description:

This course encourages and recognizes student members' work in leading the student organizationsthrough various leadership roles. As leaders they work not just to organize events and activities in specific co-curricular and extra-curricular interests, but also lead the teams that form the core members of the clubs. These activities allow students to learn and practice leadership and management skills through real world experience.

Course Educational Objectives:

- Create opportunities for students to learn from organizing club activities
- Learn teamwork, leadership, planning and management of events and activities
- Learn to appreciate multiple perspectives, cultures, and individual capabilities
- Learn to manage time effectively

List of Student Club Activities:

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc)
5. Craft (origami, model making, sculpture, pottery, etc)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multimedia, etc)
8. Workshops, quizzes, debates, elocution, etc
9. Filmmaking (adventure, drama, film appreciation, documentary, etc)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities:

1. Be the leader of the club and implement the charter, vision and mission of the club
2. Learn from diverse perspectives and experiences
3. Learn to lead the team, design and execute extra-curicular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

Textbooks:

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References:

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. Youtube- Introduction to various club activities

Course Outcomes:

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

1. Be the leader of the club and implement the charter, vision and mission of the club
2. Learn from diverse perspectives and experiences
3. Learn to lead the team, design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	3	3		3			
CO2									3	2		3			
CO3								3	3	2					
CO4										2	3	3			
CO5								2				3			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

DOSL1041	COMMUNITY SERVICES - VOLUNTEER	L	T	P	S	J	C
		0	0	0	0	2	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course recognizes student participation in Community service activities organized by various student organizations and other Government and non-government organizations that exist for providing service to communities. These activities allow students to develop empathy, citizenship behavior and community values.

Course Educational Objectives:

- To help students develop empathy and citizenship behavior
- Enable students to develop an altruistic attitude and community development sensibility
- Allow exploration of community service activities and reflect about these experiences
- Learn to work in small and large teams for achieving community objectives

List of Community Service Activities:

1. Community Health Services
2. Swachh Bharat Abhiyan and other Cleanliness drives
3. Tree Plantation and similar environmental conservation initiatives
4. Rain water harvesting awareness and implementation
5. Fundraising and visits to Orphanages, Old-age homes, etc.
6. Health and disease awareness programs
7. Working with NGOs
8. Disaster mitigation and management training and relief work
9. Rural Upliftment projects
10. Campus awareness and action projects (cleanliness, anti-ragging, blood donation, etc)
11. Community investigations and surveys for development research
12. Educational support for underprivileged (remedial classes, coaching, training, etc)
13. Service camps
14. Advocacy and information literacy initiatives
15. Other activities serving local communities

List of Activities:

1. Participation in various community service activities
2. Weekly reflection paper

3. Portfolio (on social media using an instagram account)
4. Two learning papers (one per semester)

Text Books:

1. Soul of a citizen: living with conviction in Challenging times (author: Paul Rogat Loeb)
2. Community Services intervention: Vera Lloyd

References:

1. A path appears: Transforming lives, creating opportunities (Nicholas Kristof and SherylWuDunn)
2. The story of My Experiments with Truth (author: M. K. Gandhi)

Course Outcomes:

1. Experience of volunteering in a variety of Community service activities
2. Gaining empathy for lesser privileged sections of society by experience
3. Understanding the process of generating community awareness
4. Understanding Disaster management and relief through training and experience
5. Developing environmental and sustainability awareness

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	3	3		3			
CO2									3	2		3			
CO3								3	3	2					
CO4										2	3	3			
CO5								2				3			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

DOSL1051	COMMUNITY SERVICES - MOBILIZER	L	T	P	S	J	C
		0	0	0	0	2	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course recognizes student leadership in mobilizing community service activities as members of various student organizations or other Government and non-government organizations that existfor providing service to communities. These activities allow students to develop leadership, management skills, empathy, citizenship behavior and community values.

Course Educational Objectives:

- To help students understand leadership in a community environment
- Enable students to develop an altruistic attitude and community development sensibility
- Allow deep understanding of community service through practical experience
- Learn to lead small and large teams for achieving community objectives

List of Community Service Activities:

1. Community Health Services
2. Swachh Bharat Abhiyan and other Cleanliness drives
3. Tree Plantation and similar environmental conservation initiatives
4. Rain water harvesting awareness and implementation
5. Fundraising and visits to Orphanages, Old-age homes, etc.
6. Health and disease awareness programs
7. Working with NGOs
8. Disaster mitigation and management training and relief work
9. Rural Upliftment projects
10. Campus awareness and action projects (cleanliness, anti-ragging, blood donation, etc)
11. Community investigations and surveys for development research
12. Educational support for underprivileged (remedial classes, coaching, training, etc)
13. Service camps
14. Advocacy and information literacy initiatives
15. Other activities serving local communities

List of Activities:

1. Organizing and leading teams in various community service activities
2. Fortnightly reflection paper

3. Portfolio (on social media using an instagram account)
4. Two learning papers (one per semester)

Textbooks:

1. Soul of a citizen: living with conviction in Challenging times (author: Paul Rogat Loeb)
2. Community Services intervention: Vera Lloyd

References:

1. A path appears: Transforming lives, creating opportunities (Nicholas Kristof and SherylWuDunn)
2. The story of My Experiments with Truth (author: M. K. Gandhi)
3. List of student run and other Government and non- government community service organizations

Course Outcomes:

1. Experience of mobilizing and executing Community service activities
2. Providing opportunities for community service volunteering for other fellowstudents
3. Understanding the process of mobilizing cash, kind and volunteer support
4. Building leadership and management skills
5. Building empathy and citizenship behavior

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	3	3		3			
CO2									3	2		3			
CO3								3	3	2					
CO4										2	3	3			
CO5								2				3			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

DOSP1001	BADMINTON	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Badminton - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Badminton: Grips - Racket, shuttle
4. Sports Specific fitness and warmup drills
5. Stances and footwork
6. Badminton Gameplay: Service, Forehand, Backhand
7. Preparatory Drills and Fun Games
8. Game Variations: Singles/ Doubles/ Mixed

References:

1. Handbook of the Badminton World Federation (BWF)

Course Outcomes:

1. Learn to play Badminton
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									3	2		3			
CO2												2			
CO3												2			
CO4							2		3	3	2				
CO5						2	2		3			3			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1011	CHESS	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Chess - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Chess: Pieces & functions, basic play
4. Chess board moves & terminology
5. Chess Gameplay: Openings, castling, strategies & tactics
6. Preparatory Drills and Fun Games
7. Game Variations & Officiating

References:

1. International Chess Federation (FIDE) Handbook

Course Outcomes:

1. Learn to play Chess
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									3	2		3			
CO2												2			
CO3												2			
CO4							2		3	3	2				
CO5						2	2		3			3			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1021	CARROM	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Carrom - History and development
2. Rules of the Game, Board components & dimensions
3. Fundamental Skills - Carrom: - Striking
4. Gameplay – General
5. Preparatory Drills and Fun Games
6. Game Variations: Singles/ Doubles/ Mixed
7. Preparatory Drills and Fun Games

References:

1. Indian Carrom Federation Handbook - Laws

Course Outcomes:

1. Learn to play Carrom
2. Understanding of the fundamental concepts such as rules of play, game variations

3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									3	2		3			
CO2												2			
CO3												2			
CO4							2		3	3	2				
CO5						2	2		3			3			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1031	FOOTBALL	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Football - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Kicking, heading, ball control, Keeping
4. Movement, throwins, tackling, defense, scoring, defense
5. Gameplay- Formations, passing, FKs, CKs, PK, tactics
6. Preparatory Drills and Fun Games
7. Game Variations: Small sided games, 7v7, 11v11

References:

1. FIFA Laws of the Game

Course Outcomes:

1. Learn to play Football
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									3	2		3			
CO2												2			
CO3												2			
CO4							2		3	3	2				
CO5						2	2		3			3			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1041	VOLLEYBALL	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Volley - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Striking, Ball control, Lifting
4. Sports Specific fitness and warmup drills
5. Stances and footwork
6. Preparatory Drills and Fun Games
7. Gameplay: Jumps, strikes, layoffs, attack, defense

References:

1. FIVB - Official Volleyball Rules

Course Outcomes:

1. Learn to play Volleyball
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									3	2		3			
CO2												2			
CO3												2			
CO4							2		3	3	2				
CO5						2	2		3			3			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1051	KABADDI	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Kabaddi - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Raiding, catching
4. Sports Specific fitness and warmup drills
5. Stances and footwork
6. Preparatory Drills and Fun Games
7. Gameplay: Chain system movement

References:

1. Amateur Kabaddi Federation of India (AKFI) - Official Rules

2. Rules of Kabaddi - International Kabaddi Federation

Course Outcomes:

1. Learn to play Kabaddi
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									3	2		3				
CO2												2				
CO3												2				
CO4							2		3	3	2					
CO5						2	2		3			3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1061	KHO KHO	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Kho Kho - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills: Sitting, giving Kho, Pole dive
4. Sports Specific fitness and warmup drills
5. Stances and footwork: Running, sitting
6. Gameplay: Running strategies, ring method, chain method
7. Preparatory Drills and Fun Games

References:

1. Khelo India Official Rulebook of Kho Kho

Course Outcomes:

1. Learn to play Kho Kho
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									3	2		3				
CO2												2				
CO3												2				
CO4							2		3	3	2					
CO5						2	2		3			3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1071	TABLE TENNIS	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Table Tennis - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - TT: Grips - Racket, ball
4. Stances and footwork
5. TT Gameplay- Forehand, Backhand, Side Spin, High Toss. Strokes-Push, Chop, Drive, Half Volley, Smash, Drop-shot, Balloon, Flick, Loop Drive.
6. Preparatory Drills and Fun Games
7. Game Variations: Singles/ Doubles/ Mixed

References:

1. Handbook of the International Table Tennis Federation (ITTF)

Course Outcomes:

1. Learn to play Table Tennis
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									3	2		3				
CO2												2				
CO3												2				
CO4							2		3	3	2					
CO5						2	2		3			3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1081	HANDBALL	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Handball - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Handball: Throwing, Ball control, Movement
4. Sports Specific fitness and warmup drills
5. Stances and footwork: Jumps, dribbles, catching, throws
6. Gameplay: Shots, throws, movements, attack, defense
7. Preparatory Drills and Fun Games

References:

1. International Handball Federation - Rules of the Game & Regulations

Course Outcomes:

1. Learn to play Handball
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									3	2		3				
CO2												2				
CO3												2				
CO4							2		3	3	2					
CO5						2	2		3			3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1091	BASKETBALL	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Basketball - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Passing, Receiving, Dribbling
4. Sports Specific fitness and warmup drills
5. Stances and footwork: Jumps, dribbles, catching, throws
6. Preparatory Drills and Fun Games
7. Gameplay: Shots, throws, movements, attack, defense

References:

1. FIBA Basketball Official Rules

Course Outcomes:

1. Learn to play Basketball
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									3	2		3				
CO2												2				
CO3												2				
CO4							2		3	3	2					
CO5						2	2		3			3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1101	TENNIS	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Tennis - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Tennis: Grips - Racket, ball
4. Stances and footwork
5. Gameplay- Forehand, Backhand, Service, volley, smash
6. Preparatory Drills and Fun Games
7. Game Variations: Singles/ Doubles/ Mixed

References:

1. Handbook of the International Tennis Federation (ITF)

Course Outcomes:

1. Learn to play Tennis
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									3	2		3				
CO2												2				
CO3												2				
CO4							2		3	3	2					
CO5						2	2		3			3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1111	THROWBALL	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Throwball - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Throwing, Receiving
4. Sports Specific fitness and warmup drills
5. Stances and footwork
6. Preparatory Drills and Fun Games
7. Gameplay: Shots, throws, movements, control

References:

1. World Throwball Federation - Rules of the Game

Course Outcomes:

1. Learn to play Throwball
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									3	2		3			
CO2												2			
CO3												2			
CO4							2		3	3	2				
CO5						2	2		3			3			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

ENVS1001	ENVIRONMENTAL STUDIES	L	T	P	S	J	C
		3	0	0	0	0	3*
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course enables the students to adapt eco-centric thinking and actions rather than human-centric thinking on natural resources, their utilization and conservation. The course also focuses on the importance of ecosystems, biodiversity and their degradation led to pollution. This course helps in finding solutions through application of control measures to combat pollution and legal measures to achieve sustainable development.

Course Educational Objectives:

- To impart knowledge on natural resources and its associated problems.
- To familiarize learners about ecosystem, biodiversity, and their conservation.
- To introduce learners about environment pollution.
- To acquaint learners on different social issues such as conservation of water, green buildingconcept.
- To make learners understand about the present population scenario, its impacts and role ofinformational technology on environment and human health.
- To make learners understand about the importance of field visit.

UNIT 1 Multidisciplinary nature of environmental studies & Natural Resources 10 hours

Multidisciplinary nature of environmental studies Definition, scope and importance. Need for public awareness. Natural resources and associated problems. Uses and over exploitation of Forest resources, Water resources, Mineral resources, Food resources, Energy resources. Role of an individual in conservation of natural resources.

Activity:

1. Planting tree saplings
2. Identification of water leakage in house and institute-Rectify or report
3. Observing any one day of a week as Car/bike/vehicle free day.

UNIT 2 Ecosystem and biodiversity 10 hours

Ecosystem: Structure components of ecosystem: Biotic and Abiotic components. Functional components of an ecosystem: Food chains, Food webs, Ecological pyramids, Energy flow in the ecosystem (10% law), Ecological succession.

Biodiversity: Definition, Biogeographical classification of India, Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching, man wildlife conflicts. Conservation of biodiversity: In – situ and Ex-situ

Activity:

1. Visit to Zoological Park-Noting different ecosystem
2. Biodiversity register- Flora and fauna in the campus

UNIT 3 Environmental Pollution 10 hours

Definition Causes, effects, and control measures of: -Air pollution. Water pollution. Soil pollution. Marine pollution. Noise pollution. Nuclear hazards. Solid waste Management: Causes, effects, and control measures. Role of an individual in prevention of pollution. Pollution case studies.

Activity:

1. Visit to treatment plant and documentation.
2. Documentation of segregation of solid waste-Dry and Wet

UNIT 4 Social Issues and the Environment 10 hours

From Unsustainable to Sustainable development Urban problems related to energy. Water conservation, rainwater harvesting, watershed management. Environmental ethics: Issues and possible solutions. Green building concept.

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

Activity:

1. Observing zero hour at individual level-documentation.
2. Eco friendly idols.
3. Rainwater harvesting-creating storage pits in nearby area.

UNIT 5 Human Population and the Environment and Environment Protection Act and Field work 10 hours

Population growth, variation among nations. Environment and human health. HIV/AIDS, Human rights. Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health. Environment Legislation. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Environmental Protection Act, Issues involved in enforcement of environmental legislation.

Activity:

1. Visit to a local polluted site-industry/agriculture
2. Identifying diseases due to inappropriate environmental conditions

Text Book(s):

1. Erach Bharucha. Textbook of environmental studies for undergraduates courses-Universities Press,India Private Limited. 2019.
2. Kaushik A and Kaushik C.P. Perspectives in Environmental Studies. New Age InternationalPublishers Edition-VI. 2018.
3. Dave D Katewa S.S. Textbook of Environmental Studies, 2nd Edition. Cengage Learning India. 2012.

Additional Reading:

1. Benny Joseph. Textbook of Environmental Studies 3rd edition, McGraw Hill Publishing company limited. 2017.

Reference Book(s):

1. McKinney M.L., Schoch R.M., Yonavjak L. Mincy G. Environmental Science: Systems andSolutions. Jones and Bartlett Publishers. 6th Edition. 2017.
2. Botkin D.B. Environmental Science: Earth as a Living Planet. John Wiley and Sons. 5th edition. 2005.

Journal(s):

1. https://www.tandfonline.com/loi/genv20
2. https://library.lclark.edu/envs/corejournals

Website(s):

https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf From Climate Science to Action | Coursera

Course Outcomes:

After the completion of the course student will be able to

1. List different natural resources and their uses
2. Summarize the structure and function of terrestrial and aquatic ecosystems.
3. Identify causes, effects, and control measures of pollution (air, water & soil).

4. Function of green building concept.
5. Adapt value education

CO-PO Mapping:

	Programme Objectives (POs)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2												2		
CO2		2				1							2		
CO3			1						1					1	
CO4				2							2				1
CO5	1													1	
CO6					2							1			1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN: BOS

BOS: 04-07-22 **ACADEMIC COUNCIL:14-07-22**

SDG No. & Statement:

1. SDG-6-Clean water and Sanitation
2. SDG-7-Affordable and clean energy
3. SDG-13 - Climate change
4. SDG-14 - Life below water
5. SDG-15 - Life on Land

SDG Justification:

1. The learner will understand the importance of clean water and sanitation through this course and apply in their daily activities – SDG-6

2. The learner will make use of renewable resources to reduce pollution achieves SDG-7

3. The learner will understand present situation in climate change and takes appropriate steps to combat climate change – SDG-13

4. The learner will understand the existence of life below water – SDG-14

5. The learner will understand to promote sustainable terrestrial ecosystem – SDG15

		L	T	P	S	J	C
FINA3001	**PERSONAL FINANCIAL PLANNING**	**0**	**0**	**2**	**0**	**0**	**1***
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	Risk Management in Personal financing Fundamentals of Investing Saving Money for the future Personal and Family Financial Planning Introduction to Personal Finance						

Course Description:

Personal Financial Planning is one of the most significant factors in our lives. It is essential that funds are available as and when required at various stages of life. Unavailability of funds at critical stages of our life leads to financial distress and leads to many medical and non- medical problems. There are certain planned and unplanned events in our life. On the one hand,education of our children, their marriage, our retirement etc. are some of the planned events ofour life, but at the same time, some medical urgency, accident or death of an earning member might be some unplanned events. Many of these events are beyond our control, but the availability of funds can be planned to avoid any financial distress. In other words, we cannot stop the rain but can plan for an umbrella.
This course looks at the many challenges an individual faces in a complex financial environment and the rising uncertainties of one's life. It focuses on achieving long-term financial comfort of individual and family through goal setting, developing financial and life strategies, acquiring personal financial planning knowledge and managing risk throughout one's life.

Course Educational Objectives:

- To build students' ability to plan for long-term financial comfort of individual andfamily through goal setting, developing financial and life strategies.
- To provide students with knowledge on terms, techniques to evaluate investment avenues.
- To build the skill set of the student to enable them to file their tax returns.

UNIT 1 Basics of Financial Planning

Financial Planning Meaning, Need, Objectives, Financial Planning Process, Time Value of Money and its application using excel (NP)

UNIT 2 Risk and Insurance Management

Need for insurance, Requirement of insurance interest, Role of insurance in personal finance, Steps in insurance planning, Life and Non-life insurance products, Life insurance needs analysis (NP)

UNIT 3 Investment Products and Measuring Investment Returns

Investment Products: Small Saving Instruments, Fixed Income Instruments, Alternate Investments, Direct Equity

Measuring Investment Returns: Understanding Return and its concept, Compounding concept, Real vs Nominal Rate of Return, Tax Adjusted Return, Risk-Adjusted Return (NP)

UNIT 4 Retirement Planning

Introduction to the retirement planning process, estimating retirement corpus, Determining the retirement corpus, Retirement Products (NP)

UNIT 5 Tax Planning

Income Tax: Income tax principles: Heads of Incomes, Exemptions and Deductions, Types of Assesses, Rates of Taxation, Obligations for Filing and Reporting, Tax aspects of Investment Products, Wealth Tax

Textbooks:

1. National Institute of Securities Management (NISM) Module 1 & XA
2. Madhu Sinha, Financial Planning, 2 Edition, McGraw Hill India
3. Simplified Financial Management by Vinay Bhagwat, The Times Group

References:

1. Personal Financial Planning (Wealth Management) by S Murali and K R Subbakrishna, Himalaya Publishing House.
2. Mishra K.C., Doss S, (2009). Basics of Personal Financial Planning 1e. NationalInsurance Academy, New Delhi: Cengage Learning.
3. Risk Analysis, Insurance and Retirement Planning by Indian Institute of Banking andFinance.

Course Outcomes:

1. Describe the financial planning process and application of time value of money
2. Application of life and non-life insurance products in financial planning
3. Understand the investment avenues and analysis of investment returns
4. Understand the retirement planning and its application
5. Describe and analysis the Tax Planning

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	0	0	1	0	0	1	1	1	0	3	1	1	3
CO2	2	2	0	0	1	1	1	1	0	1	1	3	1	1	2
CO3	3	2	1	0	1	0	0	1	0	1	1	3	2	2	3
CO4	3	2	0	1	1	0	1	1	0	1	1	2	2	3	2
CO5	3	3	0	1	1	1	2	1	0	1	1	1	2	2	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 01-02-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement:

Goal 4: Quality education

Goal 12: Responsible consumption and Production

SDG Justification:

Goal 4: This course enables the students to attain their financial literacy that builds in the discipline of saving and improves their lifelong learnings.

Goal 12: This course ensures sustainable consumption and helps in providing them their life long financial requirements .

<table>
<tr><td rowspan="2">LANG1012</td><td rowspan="2">COMMUNICATION SKILLS IN ENGLISH – INTERMEDIATE</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">None</td></tr>
<tr><td>Co-requisite</td><td colspan="7">None</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">None</td></tr>
</table>

Course Description

Communication Skills in English (Intermediate) is the second of the three-level graded courses for the developmental enhancement of communication skills in English. Based on the learning outcomes set in the beginner-level syllabus, this course focuses on giving learners more exposure to the use of language for communicative purposes and equipping them with next level skills (ref. Bloom's taxonomy) and practice in complexity and cognitive engagement. This course also includes the inferential level of comprehension (listening and reading) that involves analysis and application of language skills and decision-making skills while speaking/writing with an awareness of social and personality-based communication variations. This course emphasizesguided writing through adequate pre- and post-context building tasks. The focus is on the stimulation and application of critical thinking in addition to schematic review for communication in real-life situations.

Course Educational Objectives

- Train learners to listen to short audio texts with familiar content actively; guided activity like question-making and responding to others' questions based on the audio text would help learners engage in transactional dialogue; extended activities like extrapolating/critiquing the responses would help learners enhance their schematic thinking. (Bloom's Taxonomy Level/s: 2 & 4)
- Equip learners with strategies to read actively and critically and understand the writers’ viewpoints and attitude by providing reading comprehension tasks using authentic texts such as op-ed articles from newspapers, and reports on contemporary problems. (Bloom'sTaxonomy Level/s: 4 & 5)
- Help learners understand various aspects and techniques of effective presentations (group/individual) through demonstration and modelling, enabling them to develop their presentation skills by providing training in using the tips and strategies. Learners would be encouraged to observe and express opinion on teacher-modelling. Reflection on issues like anxiety, stage-fear, confidence, and levels of familiarity with topic and audience would be addressed. Practice would be given on tone, pitch, clarity and other speech aspects. Detailed peer feedback and instructor's feedback would cover all the significant aspects. (Bloom's Taxonomy Level/s: 2 & 4)
- Enable learners to become aware of the structure and conventions of academic writing through reading, demonstration, scaffolding activities, and

discussion. Corrective individual feedback would be given to the learners on their writing. (Bloom's Taxonomy Level/s: 2 & 3)

List of Tasks and Activities

S. No.	Tasks	Activities
1	Listening to subject related short discussions/explanations/ speech for comprehension	Pre-reading group discussion, Silent reading (Note-making), Modelling (questioning), Post-reading reflection /Presentation
2	Asking for information: asking questions related tothe content, context maintaining modalities	Group role-play in a context (i.e. Identifying the situation and different roles and enacting theirroles)
3	Information transfer: Visual to verbal (unfamiliarcontext); demonstration by teacher, learners' task(guided with scaffolding), learners' task (free), presentation and feedback	Pre-reading game/modelling, discussion in smallgroups, individual writing, and feedback
4	Introducing officials to peers and vice versa - Formal context	AV support, noticing, individual performance (3-4), pair work (in context), teacher modelling, group work for Introducing self and others in a formal context
5	Vocabulary in context: Find clues in a text and usethem to guess the meaning of words/phrases. Apply the newly learnt vocabulary in communication (speaking and writing).	Comprehending verbal communication: Identifying the contextual clues in oral and written texts; guessing the meaning of words/phrases in context while reading texts andlistening to discussions/talks
6	Follow the essentials of lectures, talks, discussions, reports and other forms of academicpresentations and mark individual and group presentations aided with images, audio, video, tabular data, etc.	Making power point presentation aided with images, audio, video, etc. with a small group bylistening to academic lectures/talks/ discussions,etc.
7	Collaborative work (speaking and writing) in small groups of 3 or 4 learners: discussing a general/discipline-specific topic: creating outline,assigning specific roles to members of the group;and group presentation followed by peer and instructor feedback	Pre-task modelling (peer/teacher), general discussion on structure, group work (collaboration), feedback
8	Independent reading of different text types using appropriate reference sources by adapting suitable reading styles and speed. Focus on active reading for vocabulary: low-frequency collocations and idiomatic expressions.	Brain-storming, mapping of key terms (content specific), reading and note-making (individual),oral questioning, discussion

9	Role-play (specific social and academic situations): planning (making notes), understanding nuances of speaking in context,coordinating with situational clues and fellow speakers/participants	Peer discussion for outline, A-V support, observing (teacher modelling), role play (guided), role-play (free), feedback
10	Writing a short reflective report of an event - incident/meeting/celebration	Writing a report on meetings/celebrations/events etc. by actively involved in such events and giving a short oral presentation.
11	Formal Group Discussion on topics of current interest and relevance; focus on effective participation, reflection on control over argument/counter argument, and adherence tothe conventions of formal GD	Noticing strategies from AV modelling, teacher scaffolding thoughopen-house discussion, Note-making(Group work), Group Discussion (free), post-performance discussion,Feedback
12	Speaking spontaneously on topics of interest and writing short structured essays on the same topicsadopting appropriate academic conventions and grammatical accuracy. Make sure to write accurate paragraph and essay by following: cohesion and coherence, topic sentence, introduction and conclusion	Reading for task preparation, note-making, reflection and corrective peer andteacher feedback. Practice paragraph and essay writing in groups; maintain rubrics of writing

Reference Books

1. P. Kiranmayi Dutt, Geetha Rajeevan. (2007). Basic Communication Skills. FoundationBooks. CUP
2. Harmer, J. (1998). How to teach English. Longman
3. Sanjay Kumar & Pushp Lata. (2018). Communication Skills: A Workbook. OUP.
4. Cambridge IGCSE: English as a Second Language Teacher's Book Fourth Edition.By Peter Lucantoni. CUP (2014).
5. Cambrdige Academic English: An Integrated Skills Course for EAP (Upper Intermediate)By Martin Hewings, CUP (2012)
6. Richards, J.C. and Bohlke, D. (2012). Four Corners-3. Cambridge: CUP.
7. Headway Academic Skills: Reading, Writing, and Study Skills Student's Book, Level-2 bySarah Philpot. OUP
8. Latham-Koenig, C. & Oxenden, C. (2014). American English File. Oxfor: OUP.
9. McCarthy, M. & O' Dell. F. (2016). Academic Vocabulary in Use. Cambridge: CUP

Online Resources

1. https://www.grammarly.com/blog/
2. https://www.nationalgeographic.org/education/
3. https://www.bbc.co.uk/teach/skillswise/english/zjg4scw
4. https://www.englishclub.com/
5. https://www.oxfordlearnersdictionaries.com/
6. https://dictionary.cambridge.org/
7. learnenglishteens.britishcouncil.org
8. https://freerice.com/categories/english-vocabulary

9. http://www.5minuteenglish.com/
10. https://breakingnewsenglish.com/
11. https://www.digitalbook.io/
12. https://librivox.org/

Course Outcomes

- Understand the speaker's point of view in fairly extended talks on general or discipline-specifictopics, and follow simple lines of argument in discussions on familiar contemporary issues. (Bloom's Taxonomy Level/s: 3)

- "Read and demonstrate understanding of articles and reports on limited range of contemporaryissues in which the writers adopt particular stances. Also provide samples of written communication containing fairly complex information and reasons for choices/opinions/stances. (Bloom's Taxonomy Level/s: 2 & 3)"

- Make short presentations on a limited range of general topics using slides, and engage in small group discussions sharing experiences/views on familiar contemporary issues and give reasons for choices/opinions/plans. (Bloom's Taxonomy Level/s: 3 & 4)

- Write clear, fairly detailed text (a short essay) on a limited range of general topics, and subjects of interest, and communicate clearly through email/letter to seek/pass on information or givereasons for choices/opinions/plans/actions. (Bloom's Taxonomy Level/s: 3)

- Reflect on others' performance, give peer feedback on fellow learners' presentations, responsesto writing tasks and reading comprehension questions. (Bloom's Taxonomy Level/s: 5)

CO-PO Mapping:

	PO 1	PO 2	PO3	PO 4	PO 5	PO6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PO 16	PSO 1	PSO 2	PSO3	PSO4
CO1	3	3	3	3	2	1	1	1	2	1	2	1	1	1	1	2	3	1	1	1
CO2	2	2	2	3	3	2	1	1	2	2	1	1	2	1	1	1	3	2	2	1
CO3	2	3	2	3	3	1	3	2	2	2	2	1	2	1	1	2	3	2	2	1
CO4	2	3	3	3	3	1	2	1	2	2	1	1	2	1	1	1	3	2	1	1
CO5	3	3	2	3	3	1	3	2	1	2	1	2	2	1	1	2	3	1	2	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : **ACADEMIC COUNCIL:**
SDG No. & Statement:

SDG 16 Peace and Justice Strong Institutions. Promote peaceful and inclusive societies for sustainable development, provide
access to justice for all and build effective, accountable and inclusive institutions at all levels.
SDG Justification: By relating to people with empathy, employing creative problem-solving strategies and engaging meaningfully in a diverse world will create inclusive societies for sustainable development.

<table>
<tr><td rowspan="2">LANG1022</td><td rowspan="2">COMMUNICATION SKILLS IN ENGLISH – ADVANCED</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">None</td></tr>
<tr><td>Co-requisite</td><td colspan="7">None</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">None</td></tr>
</table>

Course Description

Communication Skills in English (Advanced) is the third of the three-level graded courses for the developmental enhancement of communication skills in English. Based on the learning outcomes set in the upper-intermediate syllabus, this course focuses on giving learners exposure to higher levels of skills/input processing (ref. Bloom's taxonomy) and practice in terms of complexity and cognitive engagement. This course includes an advanced level of comprehension i.e. anaytical, evaluative, and extrapolative processing (listening and reading). It involves problem-solving, logical reasoning, and decision-making skills in terms of the application of the learning (speaking/writing) with an awareness of social and personality-based variations in communication. This course provides opportunities for activity-based practice of advanced oraland written communicative skills besides building awareness of the finer nuances of language usefor various purposes. This course emhasizes free writing through meaningfully engaging pre- and post-context-building tasks. There is ample scope for applying critical thinking through simulated activities for effective communication in real-life situations.

Course Objectives

1. Enable learners to listen actively, become aware of tone and attitude in speech, and demonstrate their comprehension of fairly complex lines of argument presented by a variety of speakers in talks/presentations/discussions. (Bloom's Taxonomy Level/s: 2 & 4)

2. Enable learners to become aware of tone and attitude in written texts, and demonstrate theircomprehension of fairly complex lines of argument and points of view presented in a variety of texts by equipping them with upper intermediate to advanced level reading skillsand strategies.

3. Make effective presentations, engage in formal group discussions, and write structured essays/ short reports to highlight the significance of actions/decisions/experiences, and sustain views by providing relevant evidence and argument.

4. Equip learners with the skills and strategies to communicate effectively in speech and writing using the language with a degree of fluency, accuracy and spontaneity, and fairly good grammatical control adopting a level of formality appropriate to the context. Encourage learners to apply their knowledge of language and their communication skills in real life situations.

List of Activities & Tasks for Assessment

S.No.	Tasks	Activities	CO
1	Evaluative and extrapolative reading of a longtext/short text on a current topic related to technology and society, identifying and questioning the author's intention, post- reading discussion in small groups, maintaining group dynamics, arriving at aconsensus. Understanging and inferring the meaning.	Pre-reading group discussion, silent reading (Note-making), modelling (questioning), post-reading reflectionand brief presentation of thoughts/ideas/opinions on the themeof the text	3
2	Debate in pairs based on listening to two recorded contemporary speeches by well-known leaders in different fields. Peer feedback and instructor feedback.	Pre-recorded audio/video for listening,student checklist for noticing keywords/concepts, pre-task orientation (by teacher), pair work, feedback	1
3	Information transfer: Visual to verbal (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation, question-answer (among students), modification, editing, proofreading,and feedback before the final version is done	Pre-reading game/modelling, discussion in small groups, independent writing and feedback	4
4	Expressing opinion on a short argumentative text (e.g. a journal article or a newspaper editorial) and justifying one's opinion/stance; focus on the use of appropriate conventions offormal and polite speech, and managing bias	Listening to group discussions/debates,reading news-paper articles on current issues and expressing opinions in favour or against the topic (in GDs, debates or writing argumentative essays).	3
5	Collaborative writing in groups of 3 -4 on topics that would require data collection andreading followed by recorded peer-reflectionand peer-feedback, group presentation and feedback	Pre-task modelling (peer), general discussion on structure, group work(collaboration), presentation, peer feedback, Open-class discussion	5
6	Writing a statement of purpose Discuss all details about the student academic and professional background, highlighting the student accomplishments,	Reading & discussion of sample statement of purposes. Discuss the content in groups and know whether all mentioned details are present. Do practice writing after lecture and discussion.	2

	goals, and how a student fit to the education applied to.	Make sure to adopt a proper writing style.	

7	Mind-mapping for advanced reading, making correlations across texts, extending the author'spoint of view	Reading texts on abstract topics and comprehending the author's perspectiveby inferring the unknown words' meaning in the context and making notes using mind-map strategy and presenting it orally.	3
8	Handling question and answer sessions after presentations: justifying arguments, taking counter-arguments, agreeing and disagreeingwith rationale	Listening to some lectures, talks, and presentations in the academic seminarsand adapting some strategies to handlethe Q&A sessions using polite and formal expressions to agree or disagree with the statements.	1
9	Learn resume and cover letter format & introduce different interview modes. Modelling an interview: with a panel of fourjudges (peers)	Pre-task activity for orientation/strategies (controlled/guided), Model interview (AV support), Group work (role play), Interview in pair (one-to-one), Interview in group (many -to-one), oral corrective feedback (peer/teacher)	2
10	Speaking on abstract and complex topics beyond his/her own area of interest/field ofstudy, using the language flexibly and effectively.	Reading texts on abstract topics and comprehending the author's perspectives. Similarly, listening to talks and discussions on an abstract topic of other discipline and making short oral presentation by sharingviews and opinions.	3
11	Self-reflection on own speech in context(recorded): tone, pitch, relevance, content; extending the reflections/ideas toothers	Listening to selected general discussions (audios and videos) and observing the language production. Recording own speech on some generaltopic and providing a critical review (self-reflection) on it by focusing on the tone, expressions and relevance ofthe content, etc.	1

12	Collaborative and individual tasks: planning, preparing (preparing an outline, structure, setting objectives, and presenting the plan of action) and executing a mini-project, and submitting a brief report on the same peer and instructor feedback after the planning stage and on completion of the mini project	Pre-task modelling (peer/teacher), general discussion on structure, groupwork (collaboration), oral correction, task distribution, presentation, feedback	5

Reference Books

1. Latham-Koenig, C. & Oxenden, C. (2014). American English File-5. Oxford: OUPRichards,
2. J.C. and Bohlke, D. (2012). Four Corners-4. Cambridge: CUP.
3. Cambrdige Academic English: An Integrated Skills Course for EAP (Advanced) By Martin Hewings and Craig Thaine, CUP (2012)
4. Berlin, A. (2016). 50 Conversation Classes: 50 Sets of Conversation Cards With an Accompanying Activity Sheet Containing Vocabulary, Idioms and Grammar. Poland: CreateSpace Independent Publishing Platform
5. Zemach, D. E., Islam, C. (2011). Writing Paragraphs: From Sentence to Paragraph. Germany: Macmillan Education.
6. Stewart, J. P., Fulop, D. (2019). Mastering the Art of Oral Presentations: Winning Orals, Speeches, and Stand-Up Presentations. United Kingdom: Wiley.
7. Kroehnert, Gary. (2010). Basic Presentation Skills. Sidney: McGraw Hill.
8. Cunninghum, S. & Moor, P. (nd). Cutting Edge (Advanced) With Phrase Builder. Longman Publishers. CUP
9. McCarthy, M & O'Dell, F. (2017). English Idioms in Use (Advanced). Cambridge: CUP. Online

Resources

1. https://www.grammarly.com/blog/
2. https://www.nationalgeographic.org/education/
3. https://www.bbc.co.uk/teach/skillswise/english/zjg4scw
4. https://www.englishclub.com/
5. https://www.oxfordlearnersdictionaries.com/
6. https://dictionary.cambridge.org/
7. learnenglishteens.britishcouncil.org
8. https://freerice.com/categories/english-vocabulary
9. http://www.5minuteenglish.com/
10. https://breakingnewsenglish.com/
11. https://www.digitalbook.io/

12. https://librivox.org/

Course Outcomes

- Listen to extended lectures, presentations, and discussions on a wide range of contemporary issues and demonstrate understanding of relatively complex lines of argument. (Bloom's Taxonomy Level/s: 2)
- Make presentations using suitable AV aids and engage in formal group discussions on a wide range of topics of contemporary interest, demonstrating awareness of standard/widely accepted conventions. (Bloom's Taxonomy Level/s: 3)
- Read and demonstrate understanding of the writer's stance/viewpoint in articles and reports on a wide range of contemporary issues and discipline-specific subjects. (Bloom's Taxonomy Level/s: 2 & 4)
- Write analytical essays on a wide range of general topics/subjects of interest, and engage in written communication (emails/concise reports) to exchange relatively complex information, giving reasons in support of or against a particular stance/point of view. (Bloom's Taxonomy Level/s: 3 & 4)

- Complete a mini project that necessitates the use of fairly advanced communication skills to accomplish a variety of tasks and submit a report in the given format. (Bloom's Taxonomy Level/s: 4 & 5

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PO 16	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	2	3	2	3	3	1	2	2	2	3	2	2	1	1	1	2	3	3	1	1
CO 2	2	3	2	3	3	1	3	3	3	3	2	2	2	1	1	2	3	3	1	1
CO 3	2	3	1	3	3	2	1	1	2	1	2	2	1	1	1	2	3	3	2	1
CO 4	3	3	3	3	3	2	1	1	3	2	2	2	1	1	1	1	3	3	2	1
CO 5	3	3	3	3	3	3	2	2	3	3	2	2	3	1	1	1	3	3	2	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : **ACADEMIC COUNCIL:**

SDG No. & Statement:

SDG 16 Peace and Justice Strong Institutions. Promote peaceful and inclusive societies for sustainable development, provide
access to justice for all and build effective, accountable and inclusive institutions at all levels.

SDG Justification: By relating to people with empathy, employing creative problem-solving strategies and engaging meaningfully in a diverse world will create inclusive societies for sustainable development.

MFST1001	HEALTH & WELLBEING	L	T	P	S	J	C
		0	0	2	0	0	1*
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course provides the students a better understanding of the role of a proper diet in maintenance of human health. This course emphasizes the composition of the food, and will help to understand how toexercise, the role of sports and physical fitness in development of a good health. The course also focuses on the importance of emotional well-being and mindfulness. This course helps in teaching the role of yoga in maintenance of physical balance.

Course Educational Objectives:

- To provide an understanding of the relationship between food and nutrition
- To emphasize the role of exercise, sports and physical fitness in obtaining a good health
- To explain about the mindfulness and emotional well being
- To teach the role of yoga and meditation in maintaining the body balance

UNIT 1

Understand the relationship between Food and Nutrition and how food composition affects nutritional characteristics. Knowledge about regulatory principles in determining diets and recommended daily allowances. Understand how to create personalised diet/nutrition plans.

UNIT 2

Understand how exercise, activity and sports helps in developing good health. Experiential exposure to the role of proper, specific nutritional interventions along with structured activities on developing proper physical health. Practical exercises and assignments in sports and exercise regimes.

UNIT 3

Introduction to emotional wellbeing and mindfulness. Teaching of mindfulness practices to reduce stress, increase relaxation and improve mental wellbeing.

UNIT 4

Introduction to Yoga theory and how Yoga helps in maintaining balance in the body. Practice of Yoga and meditation to improve overall emotional and physical balance. Practical yoga exercises and meditation techniques

Course Outcomes:

By the end of the course, student will

1. Learn the role of nutrition and diet in maintaining a good health
2. understand how the exercise, sports and physical activities will improve health
3. learn mindfulness practices for reducing stress
4. know the importance of yoga and meditation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement:

SDG Justification:

PHPY1001	GANDHI FOR THE 21ST CENTURY	L	T	P	S	J	C
		2	0	0	0	0	2*
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides the students with basic knowledge on Gandhi's early life, transformations in South Africa and his entry into India's national movement. While going through the social-political, economic, and educational philosophies of Gandhi, the course analyses how his ideologies are relevant even in the 21st century.

Course Educational Objectives:

The objectives of the course are;

- To provide the students with the basic knowledge on Gandhi’s life and his philosophies
- To understand the early influences and transformations in Gandhi
- To analyse the role of Gandhi in India’s national movement
- To apply Gandhian Ethics while analysing the contemporary social/political issues
- To appreciate the conflict resolution techniques put forward by Gandhi and its significance in thecurrent scenario.

UNIT 1 MK Gandhi: Childhood and Education

M K Gandhi, Formative Years (1869-1893): Early childhood - study in England - Indian influences, early Western influences.

UNIT 2 From Mohan to Mahatma-South African Experiences

Gandhi in South Africa (1893-1914): South African Experiences - civil right movements in South Africa - invention of Satyagraha - Phoenix settlement- Tolstoy Farm - experiments in Sarvodaya, education, and sustainable livelihood.

UNIT 3 Gandhi and Indian National Movement

Gandhi and Indian National Movement (1915-1947): Introduction of Satyagraha in Indian soil -non- cooperation movement - call for women’s participation - social boycott - Quit-India movement - fighting against un-touchability - Partition of India- independence.

UNIT 4 Gandhi and Sustainable Development

Gandhian Constructive Programs-Eleven Vows-Sarvodaya-Seven Social Sins-Gandhian Economics and Sustainable Development

UNIT 5 Gandhi and Contemporary Issues

Conflict Resolution Techniques of Gandhi-Ecological Challenges and Gandhian solutions-Gandhian Ethics-An Analysis

References:

1. Gandhi, M K. (1941). *Constructive Programme*. Ahmadabad: Navjivan Publishing House
2. Gandhi, M. K. (1948). *The Story of My Experiments with Truth*. Ahmadabad: Navjivan PublishingHouse
3. Gandhi, M K. (1968). *Satyagraha in South Africa*. Ahmadabad: Navjivan Publishing House.
4. Khoshoo, T N (1995). *Mahatma Gandhi: An Apostle of Applied Human Ecology*. New Delhi:TERI
5. Kripalani, J.B. (1970). *Gandhi: His Life and Thought*. New Delhi: Publications Division.
6. Narayan, Rajdeva (2011). *Ecological Perceptions in Gandhism and Marxism*. Muzaffarpur:NISLS
7. Pandey, J. (1998). *Gandhi and 21st Century*. New Delhi: Concept.
8. Weber, Thomas (2007).Gandhi as Disciple and Mentor. New Delhi: CUP

Course Outcomes:

After the successful completion of the course the students will be able to;

1. Understand the life of Gandhi
2. Appreciate the role of Gandhian non-violence and Satyagraha in India's freedom struggle.
3. Critically examine the philosophy of Gandhi on Education, Sarvodaya, and Satyagraha
4. Analyse the contemporary significance of Gandhian constructive programmes and eleven vows
5. Examine the possible solutions for some of the contemporary challenges like environmentalissues, moral degradation and ethical dilemmas.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	3	3	3	3	2	2	3	3	3	3
CO2	3	3	2	3	2	3	3	3	3	2	3	2	3	2	3
CO3	3	3	3	2	3	2	2	3	3	2	2	3	2	3	2
CO4	3	2	2	3	3	2	2	3	3	2	3	2	3	3	2
CO5	3	3	2	2	3	3	3	3	3	3	2	2	2	3	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement:

SDG-4: Ensure Inclusive And Equitable Quality Education And Promote Lifelong Learning Opportunities For All.

Sdg-8: Promote Sustained, Inclusive And Sustainable Economic Growth, Full And Productive Employment And Decent Work For All

SDG Justification:

Statement: This course promotes the education for all the people without considering their religion, caste, gender and regional differences.

Statement: This course deals with the basic concepts of national income and employment to understand the national level scenario of how an economy is growing and providing employment.

POLS1001	Indian Constitution and History	L	T	P	S	J	C
		2	0	0	0	0	2*
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course analyzes the basic structure and operative dimensions of the Indian Constitution. It explores various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The course also deals with various challenges faced by the constitution and its coping mechanisms. Broadly, the students would understand and explain the working of different institutions and political debates ensuing from the operation of the Indian constitution in action.

Course Educational Objectives:

- To introduce constitutional history of India.
- To explain the process of making Indian constitution
- To analyze Fundamental of Rights, Duties and other principles in constitution
- To create familiarity with political developments which shaped the constitution.

UNIT 1 India as a Nation 6 hours

Khilani, S. (2004). *Introduction, The Idea of India*, Chapter 1. New Delhi: Penguin Books, pp. 1-15.

Rowat, D. (1950). ‘India: The Making of a Nation’, International Journal, 5(2), 95-108. doi:10.2307/40194264

Brass, P. (2018). ‘Continuities and Discontinuities between pre- and post-Independence India’, Chapter 1.

The Politics of Idea since independence, New Delhi: Cambridge University Press. pp. 1-30.

UNIT 2 Understanding the Constitution 6 hours

Mehta, U.S. (2011). ‘Constitutionalism’ in *The Oxford Companion to Politics in India*, (ed) by Nirja Gopal Jayal, and Pratap Bhanu Mehta, New Delhi: Oxford University Press. pp. 15-27.

Austin, G. (2016), ‘The Constituent Assembly: Microcosm in Action’ *in The Indian Constitution: Cornerstone of a Nation*, New Delhi: Oxford University Press, pp. 1-25.

Beteille, Andre (2008): “Constitutional Morality,” *Economic and Political Weekly*, Vol 43, Issue No 40

Prahladan, Vivek (2012): "Emergence of the Indian Constitution," *Economic and Political Weekly*, Vol 47, Issue No 07.

UNIT 3 The Preamble, Fundamental Rights and Directive Principles of State Policy 6 hours

Bhakshi, P.M. (2011). 'Preamble' in *The Constitution of India*, New Delhi: Universal Law. Pp. 1-5. Laxmikanth, M. (2017). 'Chapter IV: Preamble of the Constitution' in *Indian Polity*, Chennai: McGraw Hills.

Kumar, Virendra (2007): "Basic Structure of The Indian Constitution: Doctrine of Constitutionally Controlled Governance [From Kesavananda Bharati to I.R. Coelho]" *Journal of the Indian Law Institute*, Vol 49, No 3, pp 365-398.

Austin, G (2016), ' ' in *The Indian Constitution: Cornerstone of a Nation*, New Delhi: Oxford University Press, pp.63-105.

Reddy, S (1980). Fundamental Ness of Fundamental Rights and Directive Principles in the Indian Constitution. *Journal of the Indian Law Institute*, 22(3), pp. 399-407.

Bhatia, Gautam (2017): "The Supreme Court's Right to Privacy Judgement," *Economic and Political Weekly*, Vol 52, Issue No 44

UNIT 4 Citizenship 6 hours

Jayal, N.G. (2019). 'Reconfiguring citizenship in contemporary India' in *South Asia Journal of SouthAsian Studies*, pp.33-58.

Roy, Anupama. (2010). 'Chapter I: Enframing the citizen in contemporary times' in *Mapping Citizenship in India*, New Delhi: Oxford University Press.

Das, Veena (2010): "State, Citizenship and the Urban Poor," *Citizenship Studies,* Vol 15, pp 319-333.Valerian Rodrigue

UNIT 5 Separation and Distribution of Powers 6 hours

Pal, Ruma. (2016). 'Separation of Powers' in *The Oxford Handbook of the Indian Constitution*, (ed) by Sujit Choudhry, Madhav Khosla, and Pratap Bhanu Mehta, Delhi: Oxford University Press.

Bakshi, P. (1956). 'Comparative Law: Separation of Powers in India'. *American Bar Association Journal, 42*(6), 553-595.

Rao, P. (2005). 'Separation of Powers in a Democracy: The Indian Experience'. *Peace Research, 37*(1),113-122.

Kumar, Ashwani (2019): "Constitutional Rights, Judicial Review and Parliamentary Democracy,"

Economic and Political Weekly, Vol 51, Issue 15

Tillin, Louise. (2015). 'Introduction' in *Indian Federalism*. New Delhi: Oxford University Press. pp.1-30.

Chakrabarty, Bidyut and Rajendra Kumar Pandey. (2008). *Federalism' in Indian Government andPolitics*, New Delhi: Sage Publications. pp. 35-53.

Arora, B. and Kailash, K. K. (2018). 'Beyond Quasi Federalism: Change and Continuity in IndianFederalism', in *Studies in Indian Politics*, pp. 1-7.

Agrawal, Pankhuri (2020): "COVID-19 and dwindling Indian Federalism," *Economic and PoliticalWeekly,* Vol 55, Issue No 26

Recommended Readings:

De, Rohit. (2018). *A People's Constitution – The Everyday Life of Law in the Indian Republic*, USA:Princeton University Press.

Granville Austin, *The Indian Constitution: Cornerstone of a Nation*, Oxford University Press, Oxford, 1966.

Lahoti, R.C. (2004). *Preamble: The Spirit and Backbone of the Constitution of India*. Delhi: EasternBook Company.

Rajeev Bhargava (ed), *Ethics and Politics of the Indian Constitution*, Oxford University Press, NewDelhi, 2008.

Subhash C. Kashyap, *Our Constitution*, National Book Trust, New Delhi, 2011.Tillin, Louise. (2015). *Indian Federalism*. New Delhi: Oxford University Press.

Zoya Hassan, E. Sridharan and R. Sudarshan (eds), *India's Living Constitution: Ideas, Practices,Controversies*, Permanent Black, New Delhi, 2002.

Course Outcomes:

On the successful completion of the course students would be able to:

1. Demonstrate an understanding of the Constitution of India and how constitutional governance iscarried out in India
2. Interpret knowledge of the Fundamental Rights and Duties of the Citizens as well as theObligation of the state towards its citizens
3. Correlate familiarity with key political developments that have shaped the

Constitution andamended it from time to time.
4. Equip themselves to take up other courses in law after having done a foundation course on IndianConstitution

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	3	3	2	3	1	2	1	2	1	2
CO2	1	1	2	1	2	2	3	2	3	1	2	1	1	2	1
CO3	1	2	1	2	2	2	3	1	3	1	1	1	2	1	2
CO4	1	1	1	2	2	2	3	1	3	1	1	1	1	1	2
CO5	1	1	1	2	2	2	3	2	3	1	2	1	1	1	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement:

SDG-16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

SDG Justification:

The course primarily talks about evolution of the constitutional institutions. Since the SDG-16 talks about the quality of the institutions, it is applicable here.

VEDC1001	VENTURE DEVELOPMENT	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

India as part of its "Make in India" initiative has been focusing on creating incubation centers within educational institutions, with an aim to generate successful start-ups. These start-ups will become employment creators than employment seekers, which is the need of the hour for our country. This common course (university core) for all the disciplines is a foundation on venture development. It is an experiential course that starts with students discovering their deeper self in terms of how they might contribute to society by creating exciting new products and services that can become the basis of real businesses. The students learn about the emerging areas of knowledge that are the foundations of any successful company. They will learn how to develop insight into the problems and desires of different types of target customers, and from this, to identify the design drivers for a specific innovation. Students will learn specific design methods for new products and services. The students will learn that as important as the product or service itself, is a strategy for monetizing the innovation – for generating revenue, structuring the operating costs, and creating the operating profit needed to support the business, hire new employees, and expand forward. This course is aimed to be the beginning of what might be the most important journey of personal and career discovery so far in a student's life, one with lasting impact. This is not just a course, but potentially, an important milestone in life that a student remembers warmly in the years to come.

Course Educational Objectives:

Students have the opportunity to:

- Discover who they are – Values, Skills, and Contribution to Society
- Understand how creativity works and permeates the innovation process
- Learn the basic processes and frameworks for successful innovation.
- Gain experience in going through the innovation process.
- Conduct field research to test or validate innovation concepts with target customers.

UNIT 1 PERSONAL DISCOVERY 4 hours

Personal Values, Excite & Excel, Build a Team, Define Purpose, Mission Statement

UNIT 2 IDEATION 10 hours

Ideation & Impact, User Insights - Frameworks, Customer Interviews, Interpreting Results

UNIT 3 SOLUTION DISCOVERY 8 hours

Concept Design, Competitive Analysis, Product Line Strategy, Prototyping Solutions, Reality Check

UNIT 4 BUSINESS MODEL DISCOVERY 4 hours

Understand the Industry, Types of Business Model, Define Revenue Models, Define Operating Models, Define Customer Journey, Validate Business Model

UNIT 5 DISCOVERY INTEGRATION

Define Company Impact, Create Value, Tell Your Story

L – 15; Total Hours – 30

Textbooks:

1. Meyer and Lee, “Personal Discovery through Entrepreneurship”, The Institute for Enterprise Growth, LLC. Boston, MA., USA.

References:

1. Adi Ignatius (Editor-in-Chief), “Harvard Business Review”, Harvard Business Publishing, Brighton, Massachusetts,2021

Course Outcomes:

1. Identify one’s values, strengths and weaknesses and their will to contribute to the society
2. Formulate an idea and validate it with customers
3. Demonstrate prototyping and analyse the competition for the product
4. Create business models for revenue generation and sustainability of their business
5. Come up with a pitch that can used as the basis for actually starting a company based on an impactful innovation and societal impact

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						3	1	3	3	3		3			
CO2		3		3	1	3	2	1	3	3	1	3			
CO3	1	3	3		3		3		3	1	3	3			
CO4					1	1	3	3	3	1	3	1			
CO5					3	3			3	3	3	3			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :<< date >> **ACADEMIC COUNCIL: <<date>>**

SDG No. & Statement:

4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.

SDG Justification:

4. The course involves identifying one’s personal values and working on real-life problems, thus forming the base to work on their passions even past the collegiate life.

17. The course is developed in collaboration with North-eastern University, USA and the training for the champions is being by North-eastern University.

Faculty Core

CHEM1001	CHEMISTRY	L	T	P	S	J	C
		2	1	2	0	0	4
Pre-requisite	Nil						
Co- requisite	Nil						
Preferable exposure	Nil						

Course Description:

This course enables the students to gain knowledge on various aspects of Water and its treatment, electrochemical energy systems, Construction of batteries, renewable energy sources, Semiconductors, Steel, Cement and Polymers, Corrosion and its control, nanomaterials, Analytical instruments, and applications. The knowledge gained in this course can be applied to the latest developments in technology.

Course Educational Objectives:

1. To impart knowledge on various aspects of water and its treatment.
2. To study about electrochemical energy systems, renewable energy sources, solar cells, and their applications.
3. To gain knowledge on materials such as steel, cement, and polymers
4. To create awareness on corrosion and its control.
5. To introduce different types of nanomaterials.
6. To expose the students to latest instrumental techniques such as scanning electronic microscope (SEM) & transmission electron microscope (TEM).

UNIT 1 Water and its treatment 9 Hours

Water and its treatment: Introduction – hardness of water – Causes of hardness - Types of hardness: temporary and permanent – expression and units of hardness. Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in treatment of water – Disinfection of water by chlorination and ozonization-industrial water treatment- Boiler feed water and its treatment -internal conditioning– Calgon and Phosphate conditioning. External treatment of water – Ion exchange process. Desalination of water – Reverse osmosis.

UNIT 2 Electrochemical Energy Systems 9 Hours

Battery Technology: Basic concepts, battery characteristics, classification of batteries, Important applications of batteries, Classical batteries-dry/Leclanche cell, Modern batteries-zinc air, Lead-acid storage battery, lithium cells- Lithium-ion cell, Li MnO2 cell. Fuel cells- Introduction - classification of fuel cells – hydrogen and oxygen fuel cell, propane, and oxygen fuel cell- Merits of fuel cell. **Renewable energy sources – Types of renewable energy sources. Semiconductors:** Definition, types of semiconductors: doping- n type and p – type semiconductors and applications. - **Solar cells:** Introduction, harnessing solar energy, Photovoltaic cell, solar water heaters.

UNIT 3 Engineering materials and Polymer Chemistry 8 Hours

Steel – Types of Steel, chemical composition – applications of alloy steels

Cement: Portland cement, constituents, Manufacture of Portland Cement, chemistry of setting and hardening of cement (hydration, hydrolysis, equations).

Polymer Chemistry: Concept of polymerization – Types of Polymerizations, Chain growth polymerization – mechanisms of free radical and cationic polymerizations, Thermoplastic resins and Thermosetting resins: examples- Polyethylene, Styrene, Nylon 6,6 and Bakelite. and applications, Conducting polymers:– Examples – and applications.

UNIT 4 Corrosion and its control 8 Hours

Corrosion and Its Prevention: Electrochemical theory of corrosion, Corrosion due to dissimilar metal cells (galvanic cells), Corrosion due to differential aeration cells, Uniform corrosion, pitting corrosion and stress corrosion cracking, Effect of pH, temperature and dissolved oxygen on corrosion rate. Corrosion prevention and control by cathodic protection- protective coatings- paints.

UNIT 5 Nanomaterials and Analytical Instrumental Techniques 8 Hours

Nanomaterials: Introduction to nanomaterial: nanoparticles, nanocluster, carbon nanotube (CNT) and nanowires. Chemical synthesis of nanomaterials: sol-gel method. Characterization: Principle and applications of scanning electron microscope (SEM) and transmission electron microscope (TEM)

Analytical Instrumental Techniques

Review of electromagnetic spectrum, Quantization of energy. Absorption of radiation: Beer-Lambert's law. Principle and applications of pH metry, potentiometry, conductometry, IR and UV-spectroscopy with examples.

Text Books:

1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi (2014).
2. B.K. Sharma, Engineering Chemistry, Krishna Prakashan, Meerut.
3. O G Palanna, Engineering Chemistry, Tata McGraw Hill Education Private Limited, (2009).

References:

1. Sashi chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003)
2. B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, University Press (2013).
3. S.S. Dara, A Textbook of Engineering Chemistry, S.Chand & Co, (2010)
4. N.Krishna Murthy and Anuradha, A text book of Engineering Chemistry, Murthy Publications (2014).
5. K. Sesha Maheshwaramma and Mridula Chugh, Engineering Chemistry, Pearson India Edn services, (2016).

Course Outcomes:

After the completion of the course, the student will be able to

1. List the important purification methods of water.
2. Illustrate the principles and applications of batteries, solar energy.
3. Explain the importance of materials such as steel, cement, and polymers

4. Identify different protective coatings.
5. Analyze the importance of nano materials and the principles of SEM and TEM.

CHEMISTRY LABORATORY

List of Experiments:

1. Determination of Mohr's salt by potentiometric method
2. Determination of strength of an acid by pH metric method
3. Determination of conductance by conductometric method
4. Determination of viscosity of a liquid
5. Determination of surface tension of a liquid
6. Determination of sulphuric acid in lead-acid storage cell
7. Determination of chromium (VI) in potassium dichromate
8. Determination of copper in a copper ore
9. Determination of Zinc by EDTA method.
10. Estimation of active chlorine content in Bleaching powder
11. Preparation of Phenol-Formaldehyde resin
12. Preparation of Urea-Formaldehyde resin
13. Thin layer chromatography
14. Preparation of TiO2/ZnO nano particles
15. SEM analysis of nano materials

Textbooks:

1. Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B Vogel's Quantitative Chemical Analysis 6/e, Pearson publishers (2000).
2. N.K Bhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company (2007).

Course Outcomes:

After the completion of the laboratory course, the student will be able to

1. explain the functioning of the instruments such as pH, Conductometric and Potentiometric methods.
2. identify different ores (Cr & Cu) and their usage in different fields (industry, software devices, electronic goods).
3. experiment with the physical parameter of organic compounds.
4. compare the viscosities of oils.
5. list the preparation of polymers and nano materials.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	2	2	3	1	1	2	2	3	1	3	2
CO2	3	2	1	1	3	3	3	2	1	1	3	3	1	3	3
CO3	3	2	1	1	2	3	2	2	1	1	2	3	3	1	2
CO4	3	2	2	1	2	3	3	2	2	1	2	3	3	2	2
CO5	2	2	1	2	3	3	2	2	1	2	3	2	3	1	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

CSEN1011	PROBLEM SOLVING AND PROGRAMMING WITH C	L	T	P	S	J	C
		0	0	6	0	0	3
Pre-requisite	Nil						
Co-requisite	Nil						
Preferable exposure	Familiarity with Computer system and its operation.						

***Course Description*:**

The course is designed to enable the student to write programs for problem solving. After an introduction to program logic design using algorithms and flowcharts, converting the logic into programs is taught. The features of structured programming are explained with the C programming language as an example. This course lays the foundation both for developing program logic and for writing programs in C according to the developed logic.

Course objectives:

1. Familiarize the student with the steps involved in writing and running a compiled program.
2. Enable the student to build program logic with algorithms and flowcharts.
3. Explain with the features and constructs of C programming such as data types, expressions, loops, functions, arrays, pointers, and files.
4. Demonstrate the handling of variables and input-output operations in C.
5. Train the student to convert program logic into C language code using a top-down approach.

Module I: Introduction to Computer Problem-Solving 12Hours

Introduction, the Problem-Solving Aspect, Top-Down Design, Introduction to the idea of an algorithm, Introduction to Flowchart using Raptor tool.

Introduction to C Language – Structure of a C Program, Keywords, Identifiers, Data Types (int, float, char, unsigned int) and Variable declaration, Constants, Input / Output function. Operators, Expressions, Precedence and Associativity, Expression Evaluation, Type conversions.

Exercises: Construct a flowchart and write a program to

- Develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
- Calculate simple and compound interest for various parameters specified by the user
- To enter marks of five subjects and calculate total, average and percentage.
- Calculate net salary of employee given basic,da,hra,pf and lic
- retrieve remainder after division of two numbers without using mod operator
- Convert an upper-case character to a lower-case character.
- Swap two numbers
- Enter two angles of a triangle and find the third angle.
- Check Least Significant Bit (LSB) of a number
- Input any number from user and check whether nth bit of the given number is set (1) or not (0)(hint: Use bitwise operators)

Module II: Control Structures 15 Hours

- **Control Structures:** Selection Statements (making decisions) – if, if-else, nested if, else if ladder and switch statements. Repetition statements (loops)-while, for, do-while statements, Nested Loops.
- Unconditional statements-break, continue, goto.
- Pointers – Pointer variable, pointer declaration, Initialization of pointer, accessing variables through pointers, pointers to pointers, pointers to void.

Exercises: Construct a Flowchart and Write a Program to

- Check whether the triangle is equilateral, isosceles, or scalene triangle.
- Check whether entered year is a leap year or not
- Find minimum among three numbers.
- Check whether a number is divisible by 5 and 11 or not.
- Check whether a number is positive, negative or zero using switch case.
- Design a calculator that performs arithmetic operations on two numbers using switch case
- Find Roots of a Quadratic Equation
- Find factorial of a number
- Check whether number is a palindrome or not
- Check whether number is perfect or not
- Convert a decimal number to binary number
- To find the sum of the series [1-X^2/2!+X^4/4! ....].
- Print following patterns

```
*
*
* *
* * *
* * * *
A
B B
C CC
D D D D
E E E EE
1
2 3
4 5 6
7 8 9 10
```

- Calculate the greatest common divisor of two numbers
- Generate first n numbers in the Fibonacci series
- Generate n prime numbers
- Swap two numbers using pointers.
- Performs all the five arithmetic operations using Pointers.

Module III: Functions 15 Hours

Functions-Designing Structured Programs, user defined function- function definition, function prototype, function call, Types of functions. Parameter Passing by value, parameter passing by address, Recursive functions. Dynamic Memory allocation Functions, pointers to functions. Storage classes-auto, register, static, extern.

Exercises: Write a program using functions to

- Print even and odd numbers in a given range
- Find power of a number
- Return maximum of given two numbers
- To print all strong numbers between given interval using functions.
- Check whether a number is prime, Armstrong or perfect number using functions.
- Demonstrate call by value and call by reference mechanisms.
- Find power of any number using recursion.
- Generate Fibonacci series using recursion
- Find product of two numbers using recursion
- Find the sum of digits of a number. Number must be passed to a function using pointers.
- Find GCD (HCF) of two numbers using recursion.
- Find LCM of two numbers using recursion.

Module IV: Arrays and Strings 15 Hours

Arrays – Declaration and Definition of Array, accessing elements in array, Storing values in array, linear search, binary search, bubble sort, Two – dimensional arrays, multidimensional arrays. Arrays and Pointers, Pointer Arithmetic and arrays, array of pointers, Passing array to function.
Strings – Declaration and Definition of String, String Initialization, unformatted I/O functions, arrays of strings, string manipulation functions, string and pointers.

Exercises: Write a program to

- Find minimum and maximum element in an array
- Implement linear search.
- Sort an array in descending order.
- Given a two-dimensional array of integers and a row index, return the largest element in that row.
- Find transpose of a matrix.
- Perform multiplication of two matrices
- Count total number of vowels and consonants in a string.
- Reverse the given string without using String handling functions.
- Sort strings in dictionary order
- To perform addition of two matrices.
- Read an array of elements of size ‘n’ and find the largest and smallest number using functions
- find total number of alphabets, digits or special character in a string using function

Module V: Structures and Files 15Hours

Structures–Declaration, initialization, accessing structures, operations on structures, structures containing arrays, structures containing pointers, nested structures, self-referential structures, arrays of structures, structures and functions, structures and pointers, unions.
Files – Concept of a file, Opening and Closing files, file input / output functions (standard library input / output functions for text files)

Exercises: Write a program to

- Store information of a student using structure
- Add two complex numbers by passing structures to a function

- Store information of 10 students using structures
- Store Employee information using nested structure
- Read file contents and display on console.
- Read numbers from a file and write even and odd numbers to separate file.
- Count characters, words and lines in a text file.

Textbooks(s)

- B. A. Forouzan and R. F. Gilberg, Computer Science: A Structured Programming Approach Using C, 3/e, Cengage Learning

Reference Book(s)

1. Jeri R Hanly, Elliot B Koffman, Problem Solving and Program Design in C, 7/e, Pearson Education, 2012.
2. B.W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2/E, Pearson education, 2015.
3. B. Gottfried, Programming with C, 3/e, Schaum's outlines, McGraw Hill (India), 2017.
4. P. Dey and M Ghosh, Programming in C, 2/e, Oxford University Press, 2011.

Additional Exercises:

1. Given numbers x, y, and target, return whichever of x and y is closer to the target. If they have the same distance, return the smaller of the two
2. There are three friends Ram, Raheem and Robert. Ram's age is 20, Raheem is aged three times more than his friend Ram. After 8 years, he would be two and a half times of Ram's age. After further 8 years, how many times would he be of Rams age? Robert's age is 25 now. Now program your computer to determine the final ages of all the three people after 16 years and also show who is elder.
3. Given an actual time and an alarm clock time, both in "military" format (such as 0730 for 7:30am), print how many more minutes before the alarm rings. But if the time is after the alarm, print "Alarm already went off".
4. Let there be a scenario where you and your friend are going to a restaurant. You have lunch there every fourth day, and he has his lunch there every sixth day. How many days before you meet again for lunch at the same restaurant?
5. Two friends Suresh and Ramesh have **m** red candies and **n** green candies respectively. They want to arrange the candies in such a way that each row contains equal number of candies and also each row should have only red candies or green candies. Help them to arrange the candies in such a way that there are maximum number of candies in each row.
6. On a chessboard, positions are marked with a letter between a and h for the column and a number between 1 and 8 for the row. Given two position strings, return true if they have the same colour.
7. Given two strings s0 and s1, return whether they are anagrams of each other.
8. Write a program to encrypt and decrypt a password which is alphanumeric
9. Given a string, return the string with the first and second half swapped. If the string has odd length, leave the middle character in place.
10. Given an array of integers, return the second-largest element.
11. Given lists of integers people, jobs, profits. Each person i in people have people[i] amount of strength, and performing job j requires jobs[j] amount of strength and nets profits[j] amount of profit. Given that each person can perform at most one job, although a job can be assigned to more than one person, return the maximum amount of profit that can be attained.

12. Mr. Roxy has arranged a party at his house on the New Year's Eve. He has invited all his friends - both men and women (men in more number). Your task is to generate the number of ways in which the invitees stand in a line so that no two women stand next to each other. Note that the number of men is more than the number of women and Roxy doesn't invite more than 20 guests. If there are more than 20 guests or an arrangement as per the given constraints is not possible, print 'invalid'.
13. Two friends have entered their date of birth and they want to know who is elder among them. Make a structure named Date to store the elements day, month and year to store the dates.

Case Study:

1. Create a structure containing book information like accession number, name of author, book title and flag to know whether book is issued or not. Create a menu in which the following functions can be done: Display book information, Add a new book, Display all the books in the library of a particular author, Display the number of books of a particular title, Display the total number of books in the library, Issue a book (If we issue a book, then its number gets decreased by 1 and if we add a book, its number gets increased by 1)

2. Ranjan is maintaining a store. Whenever a customer purchases from the store, a bill is generated. Record the customer name, amount due, the amount paid, mobile number with purchased items in file. At the end of day print the total income generated by store.
3. Contact Management System- Create structure to store Contact information like name, gender,mail,phone number and address. Users can add new contact and can also edit and delete existing contact. (Hint: Use Files to store data)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS12	PSO1	PSO2	PSO3
CO1	2	3	2		1				2			2	3	2	2
CO2	2	2	2		1				2			2	2	2	2
CO3	2	3	2		1				2			2	2	2	2
CO4	2	3	2		1				2			2	3	2	2
CO5	2	2	2		1				2			2	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : September 6, 2021 **ACADEMIC COUNCIL: 21st AC(September 17, 2021)**

SDG No. & Statement: 4 Quality Education, Decent Work and Economic Growth

4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

SDG Justification:

Learning various problem-solving techniques will lead to become a good problem solver.

CSEN1021	PROGRAMMING WITH PYTHON	L	T	P	S	J	C
		0	0	6	0	0	3
Pre-requisite	Nil						
Co-requisite	Nil						
Preferable exposure	Familiarity with Computer system and its operation.						

Course Educational objectives:

1. To elucidate problem solving through python programming language
2. To introduce function-oriented programming paradigm through python
3. To train in development of solutions using modul ar concepts
4. To teach practical Python solution patterns

Module I: Introduction to Python 18 **Hours**

Python – Numbers, Strings, Variables, operators, expressions, statements, String operations, Math function calls, Input/output statements, Conditional If, while and for loops.

Exercises:

1. Accept input from user and store it in variable and print the value.
2. Use of print statements and use of (.format)for printing different data types.
3. Take 2 numbers as user input and add, multiply, divide, subtract, remainder and print the output (Same operations on floating point input as well)
4. Conversion of one unit to another (such as hours to minutes, miles to km and etc)
5. Usage of mathematical functions in python like math.ceil, floor, fabs, fmod, trunc, pow, sqrt etc.
6. Building a mathematical calculator that can perform operations according to user input. Use decision making statement.
7. Accepting 5 different subject marks from user and displaying the grade of the student.
8. Printing all even numbers, odd numbers, count of even numbers, count of odd numbers within a given range.
9. a) Compute the factorial of a given number. b) Compute GCD of two given numbers. c) Generate Fibonacci series up to N numbers.
10. Check whether the given input is a) palindrome b) strong c) perfect
11. Compute compound interest using loop for a certain principal and interest amount

Module II: Functions **18 Hours**

User defined Functions, parameters to functions, recursive functions. Lists, Tuples, Dictionaries, Strings.

Exercises:

- Create a function which accepts two inputs from the user and compute ${}^{n}C_{r}$
- Recursive function to compute GCD of 2 numbers
- Recursive function to find product of two numbers
- Recursive function to generate Fibonacci series
- Program to print a specified list after removing the 0th, 4th and 5th elements.
  Sample List : ['Red', 'Green', 'White', 'Black', 'Pink', 'Yellow']
  Expected Output : ['Green', 'White', 'Black']
- Program to get the difference between the two lists.
- Program to find the second smallest number and second largest number in a list.
- Given a list of numbers of list, write a Python program to create a list of tuples having first element as the number and second element as the square of the number.
- Given list of tuples, remove all the tuples with length K.
  Input : test_list = [(4, 5), (4,), (8, 6, 7), (1,), (3, 4, 6, 7)], K = 2
  Output : [(4,), (8, 6, 7), (1,), (3, 4, 6, 7)]
  Explanation : (4, 5) of len = 2 is removed.
- Program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x*x).
  Sample Input: (n=5) :
  Expected Output : {1: 1, 2: 4, 3: 9, 4: 16, 5: 25}
- Program to remove a key from a dictionary
- Program to get the maximum and minimum value in a dictionary.
- Program to perform operations on string using unicodes ,splitting of string,accessing elements of string using locations
- Program for Counting occurrence of a certain element in a string, getting indexes that have matching elements.For ex -.In Rabbit count how many times b has occurred . Example-I have to go to a doctor and get myself checked. Count the number of occurrences of ‘to’.
- Program for replacing one substring by another For example - Rabbit - Replace ‘bb’ by ‘cc’
- Program to Acronym generator for any user input (ex-input is Random memory access then output should be RMA).Example - Random number (RN)
- Python function that accepts a string and calculates the number of uppercase letters and lowercase letters.
- Program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings

  Sample List : ['abc', 'xyz', 'aba', '1221'] Expected Result : 2

Module III: Files and Packages 18 Hours

Files—Python Read Files, Python Write/create Files, Python Delete Files.

Pandas -- Read/write from csv, excel, json files, add/ drop columns/rows, aggregations, applying functions.

Exercises

- read an entire text file.
- read the first n lines of a file.
- append text to a file and display the text.
- Read numbers from a file and write even and odd numbers to separate files.
- Count characters, words and lines in a text file.
- To write a list to a file.
- Given a CSV file or excel file to read it into a data frame and display it.
- Given a data frame, select rows based on a condition.
- Given is a data frame showing the name, occupation, salary of people. Find the average salary per occupation.
- To convert Python objects into JSON strings. Print all the values.
- Write a Pandas program to read specific columns from a given excel file.

Module IV: Operations in database with suitable libraries **18 Hours**

SQLite3: CRUD operations (Create, Read, Update, and Delete) to manage data stored in a database.

Matplotlib -- Visualizing data with different plots, use of subplots. User defined packages, define test cases.

Exercises

Special commands to sqlite3 (dot-commands)
Rules for "dot-commands"
Changing Output Formats
Querying the database schema
Redirecting I/O
Writing results to a file
Reading SQL from a file
File I/O Functions
The edit() SQL function
Importing CSV files
Export to CSV
Export to Excel

Reference - https://www.sqlite.org/cli.html

Matplotlib can be practiced by considering a dataset and visualizing it.
It is left to the instructor to choose appropriate dataset.

Module V: Regular Expressions **18 Hours**

Regular expression: meta character, regEx functions, special sequences, Web scrapping, Extracting data.

Exercises

Write a Python program to check that a string contains only a certain set of characters (in this case a-z, A-Z and 0-9).
Write a Python program that matches a string that has an a followed by zero or more b's
Write a Python program that matches a string that has an a followed by one or more b's
Write a Python program that matches a string that has an a followed by zero or one 'b'
Write a Python program that matches a string that has an a followed by three 'b'
Write a Python program to find sequences of lowercase letters joined with an underscore

Write a Python program to test if a given page is found or not on the server.
Write a Python program to download and display the content of robot.txt for en.wikipedia.org.
Write a Python program to get the number of datasets currently listed on data.gov
Write a Python program to extract and display all the header tags from en.wikipedia.org/wiki/Main_Page
.
Textbooks(s)

1. Programming with python, T R Padmanabhan, Springer
2. Python Programming: Using Problem Solving Approach, Reema Thareja, Oxford University Press

Reference Book(s)

1. Programming with python, T R Padmanabhan, Springer
2. Python Programming: Using Problem Solving Approach, Reema Thareja, Oxford University Press
3. Python for Data Analysis, Wes McKinney, O.Reeilly

Course Outcomes:
After completion of this course the student will be able to

- Define variables and construct expressions.
- Utilize arrays, storing and manipulating data.
- Develop efficient, modular programs using functions.
- Write programs to store and retrieve data using files.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS12	PSO1	PSO2	PSO3
CO1	2	3	2		1				2			2	3	2	2
CO2	2	2	2		1				2			2	2	2	2
CO3	2	3	2		1				2			2	2	2	2
CO4	2	3	2		1				2			2	3	2	2
CO5	2	2	2		1				2			2	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : September 6, 2021 **ACADEMIC COUNCIL: 21^{st} AC(September 17, 2021)**

SDG No. & Statement: 4 Quality Education

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Learning a programming language like Python students can get decent jobs in different fields.

<table>
<tr><td rowspan="2">CSEN1031</td><td rowspan="2">ARTIFICIAL INTELLIGENCE APPLICATIONS</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">CSEN1011: Problem Solving and Programming with C
CSEN1021: Programming with Python</td></tr>
<tr><td>Co- requisite</td><td colspan="7">Nil</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">Programming</td></tr>
</table>

Course Description:

The surge in the production of data has led to the development of various technologies. The term "Artificial Intelligence (AI)" has become ubiquitous in everyday applications from virtual assistants to self-driving cars. Several applications such as Healthcare, Finance, Bioinformatics etc. are benefitting from the advances in the domain. The global market for artificial intelligence is going to face a phenomenal growth over the coming years with organizations across the world capitalizing on the disruptive technologies that AI is offering. This course introduces the recent applications of AI namely, Virtual Assistants, Computer Vision, along with trending topics such as Deep Learning and Reinforcement Learning. The idea of the course is to introduce the basic concepts of AI as well as latest trends in the domain. This course is envisaged to provide a basic understanding on latest developments of AI to all disciplines engineering undergraduates.

Course Educational Objectives:

1. Provide introduction to basic concepts of artificial intelligence.
2. Explore applications of AI
3. Explore the scope, advantages of intelligent systems
4. Experiment with different machine learning concept
5. Exposure to AI-intensive computing and information system framework

UNIT 1 **2 Hours**

Introduction to Artificial intelligence: Basics of AL Agents and Environment, The Nature of Environment.

List of Experiment(s):

Implementation of toy Problems (8-Puzzle, Wumpus World, Vacuum-clean Example, etc)

UNIT 2 **2 Hours**

Applications of AI: Game Playing, [Deep Blue in Chess, IBM Watson in Jeopardy, Google's Deep Mind in AlphaGo]

List of Experiment(s):

1. Implementation of (Sudoku, Crossword Puzzle, or Wumpus World, etc)

UNIT 3 **2 Hours**
Conceptual introduction to Machine Learning: Supervised, Unsupervised, and Semi-Supervised Learning.
List of Experiment(s):
1. Supervise - Perform Data Labelling for various images using object recognition

UNIT 4 **2 Hours**
Reinforcement Learning, Introduction to Neural Networks, Deep Learning
List of Experiment(s):
1. Explore the effect of different hyperparameters while implementing a Simple Fully Connected Neural Network. (https://playground.tensorflow.org)

UNIT 5 **2 Hours**
Image Processing & Computer Vision: Introduction to Image processing, Image Noise, Removal of Noise from Images, Color Enhancement, Edge Detection.
List of Experiment(s):
1. Lobe.ai - Build custom models using the visual tool for Object recognition and sentiment analysis that can convert facial expressions into emoticons

UNIT 6 **2 Hours**
Segmentation. Feature Detection & Recognition. Classification of images. Face recognition, Deep Learning algorithms for Object detection & Recognition.
List of Experiment(s):
1. Teachable Machine Brain.JS In Browser Object Recognition through
2. Haar Cascade Object detection for Eye and Face in Python using Open CV

UNIT 7 **2 Hours**
Conceptual introduction to Natural Language Processing: Speech Recognition & Synthesis: Speech Fundamentals, Speech Analysis, Speech Modelling.
List of Experiment(s):
1. Sentiment Analysis and Polarity detection

UNIT 8 **2 Hours**
Speech Recognition, Speech Synthesis, Text-to-Speech, Sentiment Analysis, Segmentation and recognition.
List of Experiment(s):
1. Text to Speech recognition and Synthesis through APIs

UNIT 9 **2 Hours**
Introduction to o Chatbot, Architecture of a Chatbot. NLP in the cloud, NL Interface, How to Build a Chatbot, Transformative user experience of chatbots, Designing Elements of a chatbot, Best practices for chatbot development. NLP components. NLP wrapper to chatbots. Audiobots and Musicbots.
List of Experiment(s):
1. Building a Chatbot using IBM Watson visual studio
2. Building a Chatbot using Pandora bots
3. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python

UNIT 10 **2 Hours**

Smart Applications: Smart Manufacturing, Smart Agriculture, Smart Healthcare, Smart Education, Smart Grids, Smart Transportation and Autonomous Vehicles, Smart Homes, Smart Cities

List of Experiment(s):

1. Build a smart application specific to the domain of the student.

Textbooks:

1. Tom Markiewicz& Josh Zheng, Getting started with Artificial intelligence, Published by O'Reilly Media,20l7
2. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach.

References:

1. Aurtlien Giron. Hands on Machine Learning with Scikit-Learn and TensorFlow concepts,Tools, and Techniques to Build intelligent Systems , Published by O'Reilly Mcdia,20l 7
2. Build an AI Assistant with wolfram alpha and Wikipedia in python.https://medium .com/@salisuwy/build-an-ai-assistant-with-wolfram-alpha-and-wikipedia-in-python-d9bc8ac838fe.
3. Joseph Howse, Prateek Joshi, Michael Beyeler - Opencv Computer Vision Projects withPython-Publishing (201 6).
4. Curated datasets on kaggle https://www.kaggle.com/datasets.

Course Outcomes:

1. Able to grasp the concepts of artificial intelligence, machine learning, natural language processing, image processing
2. Recognize various domains in which Al can be applied
3. Implement the methods in processing an image:
4. Implement simple of chatbots
5. identify smart applications:

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2		1				2			2	3	2	2
CO2	2	2	2		1				2			2	2	2	2
CO3	2	3	2		1				2			2	2	2	2
CO4	2	3	2		1				2			2	3	2	2
CO5	2	2	2		1				2			2	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : September 6, 2021

ACADEMIC COUNCIL: 21st AC(September 17, 2021)

SDG No. & Statement:

SDG Justification:

<table>
<tr><td rowspan="2">EECE1001</td><td rowspan="2">BASIC ELECTRICAL AND ELECTRONICS ENGINEERING</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>2</td><td>1</td><td>2</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">Nil</td></tr>
<tr><td>Co- requisite</td><td colspan="7">Nil</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">Nil</td></tr>
</table>

Course Description:

This course introduces the fundamental principles and building blocks of electrical and electronics engineering. The first three units cover the electric circuit laws, theorems, and principles of electrical machines. The last two units cover semiconductor devices and their applications.

Course Educational Objectives:

1. To impart the analysis and design aspects of DC networks in electrical and electronic circuits
2. To explain the basic concepts of AC networks used in electrical and electronic circuits.
3. To demonstrate the importance and operating principles of electrical machines (transformers, motors and generators)
4. To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, Metal Oxide Semiconductor Field Effect Transistors (MOSFETs).
5. To expose basic concepts and applications of Operational Amplifier and configurations.

UNIT 1 **7 Hours**

DC Circuits: Basic circuit elements and sources, Ohms law, Kirchhoff’s laws, series and parallel connection of circuit elements, Node voltage analysis, Mesh current analysis, Superposition, Thevenin’s and maximum power transfer theorem.

UNIT 2 **8 Hours**

AC Circuits: Alternating voltages and currents, AC values, single phase RL, RC, RLC series circuits, power in AC circuits, Power Factor, three phase systems-Star and Delta Connection-Three phase power measurement.

UNIT 3 **9 Hours**

Electrical Machines: Construction, working principle and application of DC machines, Transformers, single phase and three phase Induction motors, special machines-Stepper motor, Servo motor and BLDC motor.

UNIT 4 **8 Hours**

Semiconductor Devices: p-n Junction diode - Basic operating principle, current-voltage characteristics, rectifier circuits (half-wave, full-wave, rectifier with filter capacitor), Zener diode as Voltage Regulator; Metal oxide semiconductor field effect transistor (MOSFET): Operation of NMOS and PMOS FETs, MOSFET as an amplifier and switch.

UNIT 5 **8 Hours**

Operational Amplifiers: The Ideal Op-amp, The Inverting Configuration, The closed loop gain, Effect of Finite open-loop gain, The Noninverting Configuration, The closed loop gain, Characteristics of Non-Inverting Configuration, Difference amplifiers, A Single Op-amp difference amplifier. Adders, subtractors, integrators, differentiators, filter circuits using Opamps,

Basic Electrical and Electronics Engineering Laboratory

List of Experiments:

1. Verification of Kirchhoff's Laws.
2. Verification of DC Superposition Theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Maximum power transfer Theorem.
5. Load test on DC generator.
6. Load test on single phase transformer.
7. Measurement of voltage, current and power factor of single phase RL, RC series circuits.
8. Measurement of voltage, current and power factor of single phase RLC series circuit.
9. Measurement of power in a three phase circuit.
10. Current Voltage Characteristics of a p-n Junction Diode/LED.
11. Diode Rectifier Circuits.
12. Voltage Regulation with Zener Diodes.
13. Design of a MOSTFET amplifier and MOSFET inverter/NOR gate
14. Inverting and Non-inverting Amplifier Design with Op-amps.
15. Simulation experiments using PSPICE
    a) Diode and Transistor Circuit Analysis.
    b) MOSFET Amplifier design.
    c) Inverting and Noninverting Amplifier Design with Op-amps.

Textbooks:

1. D. P. Kothari, I. J. Nagrath, Basic Electrical and Electronics Engineering, 1/e, McGraw Hill Education (India) Private Limited, 2017.
2. B. L. Theraja, Fundamentals of Electrical Engineering and Electronics, 1/e, S. Chand Publishing, New Delhi, 2006.
3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits 6/e, Oxford University Press, 2014.

References:

1. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education,

2011.
2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008.
3. R. K. Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi, 2012.

Course Outcomes:

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

1. predict and analyse the behaviour of an electrical circuit (L3).
2. analyse the performance quantities such as losses, efficiency and identify applications of DC machines (L4).
3. explain the use of transformers in transmission and distribution of electric power and other applications (L2).
4. demonstrate the operation and applications of various electronic devices (L2).
5. construct Inverting and Noninverting configurations of Op-amp (L3).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:
SDG3: Good Health and Well Being: Understanding the fundamentals of electrical and electronics systems can help in designing systems, to promote good health and well being

SDG5: Gender Equality: Acquiring the interdisciplinary knowledge help overcome the gender barriers in workplace

SDG8: Descent Work and Economic: The learners of this course can get descent work and earn financial benefits and they can work in interdisciplinary areas

SDG12: Responsible Consumption and Production: Use of right and energy efficient electric and electronic components and devices results in reasonable consumption and production
SDG Justification:

<table>
<tr><td rowspan="2">HSMCH102</td><td rowspan="2">UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">Nil</td></tr>
<tr><td>Co- requisite</td><td colspan="7">Nil</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">Nil</td></tr>
</table>

Course Description:

During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

Course Educational Objectives:

The objective of the course is fourfold:

1. Development of a holistic perspective based on self- exploration about themselves (human being), family, society, and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

COURSE TOPICS: The course has 28 lectures and 14 practice sessions in 5 modules:

UNIT 1 Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I.
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration.
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT 2 Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’.
2. Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility.
3. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer).
4. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’.
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
6. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available tome. Identifying from one’s own life.
Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT 3 Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students’ lives.

UNIT 4 Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature.
3. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.

4. Holistic perception of harmony at all levels of existence.
5. Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.

UNIT 5 Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order:
    a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
    b. At the level of society: as mutually enriching institutions and organizations
7. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

Text Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

References:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)

13. Gandhi - Romain Rolland (English)

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor’s role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one’s own self and do self- observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up “ordinary” situations rather than” extra-ordinary” situations.

Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials)would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty.

Teacher preparation with a minimum exposure to at least one 8- day FDP on Universal Human Values is deemed essential.

ASSESSMENT:
This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:
Assessment by faculty mentor: 10 marks
Self-assessment: 10 marks
Assessment by peers: 10 marks
Socially relevant project/Group Activities/Assignments: 20 marks Semester End Examination:

50 marks
The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

Course Outcomes:
By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to- day settings in real life, at least a beginning would be made in this direction.

This is only an introductory foundational input. It would be desirable to follow it up by

a. faculty-student or mentor-mentee programs throughout their time with the institution
b. Higher level courses on human values in every aspect of living. E.g. as a professional

INTN2333	INTERNSHIP 1	L	T	P	S	J	C
		0	0	0	0	1	1
Pre-requisite	Completion of minimum of four semesters						
Co- requisite							
Preferable exposure							

Course Educational Objectives:

1. The course is designed to expose the students to expected industry skills and industry environment and to take up onsite assignment as trainees or interns.

Contents: **1 Week**

One week of work at industry site. Supervised by an expert at the industry.

Mode of Evaluation: Internship Report, Presentation and Project Review

Course Outcomes:

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. identify skill set required to participate activity in real-time projects relevant to the industry
3. Understand the impact of engineering solutions in a global, economic, environmental and societal context
4. formulate technical background required to participate in Internship 2

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

INTN3444	INTERNSHIP 2	L	T	P	S	J	C
		0	0	0	0	1	3
Pre-requisite	Completion of minimum of six semesters						
Co- requisite							
Preferable exposure							

Course Educational Objectives:

1. The course is designed to expose the students to industry environment and to take up onsite assignment as trainees or interns.

Contents: **1 Week**

Four weeks of work at industry site. Supervised by an expert at the industry

Mode of Evaluation: Internship Report, Presentation and Project Review

Course Outcomes:

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

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

<table>
<tr><td rowspan="2">MATH1001</td><td rowspan="2">SINGLE VARIABLE CALCULUS</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Co- requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">NIL</td></tr>
</table>

Course Description:

This course is designed to impart knowledge on differentiation and integration of function, emphasizing their inter-relationship and applications to engineering.

Course Educational Objectives:

1. To familiarize the students in the concepts the derivatives and its underlying concepts like limits and continuity.
2. To explain the concept of derivative and calculation of extreme values of extreme values of various functions.
3. To impart knowledge on integration for the computation of areas, arc lengths.
4. To demonstrate various techniques of integrations.

UNIT 1 Limits and continuity of single and several variables 6 Hours

Limit of a Function and Limit Laws, The Precise Definition of a Limit, One-Sided Limits, Continuity (Without proofs). Functions of Several Variables, Limits and Continuity in Higher Dimensions (Without proofs)

UNIT 2 Derivatives and applications 7 Hours

The Derivative as a Function, Differentiation Rules, The Chain Rule, Extreme Values of Functions on Closed Intervals, Monotonic Functions (Without proofs)

UNIT 3 Integrals and applications 7 Hours

The Definite Integral, The Fundamental Theorem of Calculus, Indefinite Integrals and the Substitution Method, Definite Integral Substitutions and the Area between Curves, Arc Length (Without proofs)

UNIT 4 Techniques of integration 6 Hours

Using basic Integration Formulas, Integration by Parts, Trigonometric Integrals, Trigonometric Substitutions, Integration of Rational Functions by Partial Fractions (Without proofs)

Textbooks:

1. Joel Hass, Christopher Heil, Maurice D. Weir, Thomas' Calculus, Fourteenth edition, Pearson Addison Wesley (2018).

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics,10/e, John Wiley & Sons, 2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
4. Hyghes-Hallett, Gleason, McCallum et al. Single Variable Calculus (6th Edn) John Wiley and Sons New York, 2013.

Course Outcomes:

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

- determine limit, one sided limit, continuity of single and several variable functions.
- solve problems in a range of mathematical applications using differentiation
- solve problems in a range of mathematical applications using integration
- apply the fundamental theorem of calculus.
- evaluate integrals using various techniques.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4
Ensure inclusion and equitable quality education and promote lifelong opportunities for all

SDG Justification:
Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH1011	SEVERAL VARIABLE CALCULUS	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	MATH1001						
Co- requisite	NIL						
Preferable exposure	Engineering and Science						

Course Description:

This course is designed to impart knowledge on calculus of functions of more variables which are useful in modelling and analyzing physical phenomena involving continuous change of variables or parameters and have applications across all branches of engineering.

Course Educational Objectives:

1. To teach basic concepts of partial derivatives.
2. To explain the evaluation of double integrals and its applications.
3. To demonstrate the evaluation and applications of triple integrals.
4. To acquaint the knowledge of line and surface integrals and applications.

UNIT 1 Partial derivatives and applications 7 Hours

Partial Derivatives of a Function of Two Variables and More Than Two Variables, Second-order Partial derivatives, The Chain Rule for Functions of Two and Three variables, Extreme Values and Saddle Points, Lagrange Multipliers, Taylor's Formula for Two Variables (Without proofs)

UNIT 2 Double integrals 6 Hours

Double and iterated Integrals over Rectangles, Double Integrals over General Regions, Area by Double Integration: Area of bounded region in a plane, Double Integrals in Polar Form. (Without proofs)

UNIT 3 Triple integrals 5 Hours

Triple Integrals in Rectangular Coordinates: Triple Integrals, Volume of a Region in Space, Finding limits of integration, Triple Integrals in Cylindrical and Spherical Coordinates. (Without proofs)

UNIT 4 Integrals and Vector fields 8 Hours

Vector Fields and Line Integrals: Line Integrals of Vector Fields, Line Integrals with Respect to dx, dy, or dz, Work Done by a Force over a Curve in Space, Green's Theorem in the Plane: Tangential form, Using Green's Theorem to Evaluate the Line Integral and Verification, Surface Integrals: Surface Integrals of Vector Fields, Stokes' Theorem (Without proofs)

Textbooks:

1. Joel Hass, Christopher Heil, Maurice D. Weir, Thomas' Calculus, Fourteenth edition,

Pearson Addison Wesley (2018).

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics,10/e, John Wiley & Sons, 2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
3. Hyghes-Hallett, Gleason, McCallum et al. Multivariable Variable Calculus (6th Edn) John Wiley and Sons New York, 2013.
4. James Stewart. Multivariate Calculus, Concepts and Contexts. (3rd Edn) Thomson/Brooks/Cole, Canada, 2005.

Course Outcomes:

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

- utilize functions of several variables in optimization.
- employ the tools of calculus for calculating the areas.
- calculate volumes using multiple integrals.
- determine the work done using vector calculus
- determine the rate of flow of a fluid using vector calculus

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensure inclusion and equitable quality education and promote lifelong opportunities for all

SDG Justification:

Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH2371	DIFFERENCE EQUATIONS	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	**NIL**						
Co- requisite	**NIL**						
Preferable exposure	**Engineering and Science**						

Course Description:

Difference equations is the study of equation which involves the difference of a discrete function. In this course, the student can form a difference equation, solving linear higher order difference equations using analytical techniques, simultaneous linear difference equations and also find the solution of linear higher order difference equations and simultaneous difference equations using Z-transforms.

Course Educational Objectives:

1. Student is able to know how to find the order of a difference equation and complementary function of a difference equation.
2. Student is able to know how to find the particular solution of a difference equation and also find the solutions of simultaneous linear difference equations.
3. Student is able to know how to find Z-transforms a discrete function using properties and using to basic theorems.
4. Student is able to know how to find the inverse Z-transforms a function and also using convolution theorem.
5. Student is able to know how to find the solution of a difference equation using Z-transforms

UNIT 1 **Difference equations - I** **5 Hours**

Introduction, definition of order, and solution of difference equation, formation of difference equations, linear difference equations, complementary function, rule for finding complementary function.

UNIT 2 **Difference equations-II** **5 Hours**

Particular integrals, Rule for finding particular integrals, simultaneous linear difference equations.

UNIT 3 **Z-transforms** **5 Hours**

Introduction, Definition, some standard Z-transforms, linear property, damping rule, Shifting U_n to the **right and to the left, Multiplication by n, two basic theorems.**

UNIT 4 **Inverse Z-transforms** **5 Hours**

Convergence of Z-transforms, evaluation of inverse Z-transforms, properties, convolution theorem.

UNIT 5 Applications of Z-transforms 5 Hours

Solving difference equations and simultaneous linear difference equations with constant coefficients by Z-transforms.

Textbooks:

1. "Higher Engineering Mathematics" by B.S. Grewal published by Khanna Publishers

References:

1. Advanced Engineering mathematics by Irvin Kreyszig

Course Outcomes:

1. Able to find the order of a difference equation and complementary function of a difference equation.
2. Able to find the particular solution of a difference equation and also find the solutions of simultaneous linear difference equations.
3. Able to find Z-transforms a discrete function using properties and using to basic theorems.
4. Able to find the inverse Z-transforms a function and also using convolution theorem.
5. Able to find the solution of a difference equation using Z-transforms

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensure inclusive and equitable quality education and promote lifelong opportunities for all

SDG Justification:

Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH1031	DIFFERENTIAL EQUATIONS	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	**NIL**						
Co- requisite	**NIL**						
Preferable exposure	**Engineering and Science**						

Course Description:

This course is designed to impact the knowledge on ordinary, partial differential equations and their applications.

Course Educational Objectives:

6. To familiarize the students with the basic concepts of ordinary differential equations.
7. To demonstrate the evaluation and applications of first order differential equations.
8. To explain the evaluations of linear homogeneous and non-homogeneous differential equations.
9. To familiarize the students with the basic concepts of partial differential equations.
10. To explain the concepts of first order partial differential equations.
11. To demonstrate the evaluation of differential equations using math software's

UNIT 1 First Order Ordinary Differential Equations 5 Hours

Order and Degree of an Ordinary Differential Equation (ODE), ODE's of first order and first degree, Variable separable method, Linear Equations, Bernoulli's Equations.

UNIT 2 Linear Ordinary Differential Equations of High Order 6 Hours

Definitions, Complete Solution, Operator D, Complimentary function, Inverse operator, Rules for finding particular integral (e^{ax}, sinbx/cosbx, x^m& $e^{ax}v(x)$)

UNIT 3 Applications of Linear Ordinary Differential Equations of Higher Order 5 Hours

Method of Variation of Parameters, Simple Harmonic Motion, Oscillations of a Spring

UNIT 4 Introduction to Partial Differential Equations 5 Hours

Introduction, Formation of Partial Differential Equation(PDE), Solutions of a PDE, Equations solvable by direct integration, Linear equations of the first order.

UNIT 5 Partial Differential Equations of Second Order 5 Hours

Homogeneous linear equations with constant coefficients, Rules for finding the complementary function and particular integral, Working procedure to solve the equations.

Textbooks:

1. Simmons, G.F., Differential Equations with Applications and Historical Notes, Second Edition, McGraw-Hill, Inc., 1991.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

References:

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984
2. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.
3. Erwin Kreyszig, Advanced Engineering Mathematics,10/e, John Wiley & Sons, 2018.

Course Outcomes:

1. Form and find the solution of an ordinary differential equation.
2. Apply the concept of differential equations to solve real world problems.
3. Evaluate linear homogeneous and non homogeneous differential equations
4. Form and find the solution of a partial differential equations of first order.
5. Evaluate second order partial differential equations and solution of differential equations using computational tool.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4
Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:
Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH2281	NUMERICAL TECHNIQUES	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	**NIL**						
Co- requisite	**NIL**						
Preferable exposure	**Engineering and Science**						

Course Description:

This course is designed to enhance problem solving skills of engineering students using a powerful problem-solving tool namely numerical Techniques. The tool is capable of handling large systems of equations, nonlinearities and complicated geometries that are common in engineering practice but often impossible to solve analytically.

Course Educational Objectives:

1. To familiarize the students with numerical solutions of nonlinear and systems of linear equations.
2. To get exposed to finite differences and interpolation.
3. To demonstrate the numerical differentiation and integration.
4. To explain the numerical solutions of ordinary differential equations

UNIT 1 Solution of algebraic and transcendental equations 6 Hours

Regula-falsi method and Newton- Raphson method. **Solution of linear system of equations**-Iterative methods: Gauss Jacobi method, Gauss Seidel method, and finding the eigenvalues of a matrix by Power method.

UNIT 2 Interpolation 5 Hours

Difference operators (shifting, delta, del) and difference tables, Newton's forward and backward interpolation formulae, Divided difference formula, and Lagrange's interpolation formula.

UNIT 3 Numerical Differentiation and Numerical Integration 5 Hours

Numerical Differentiation: Derivatives using forward, and backward difference formulae.
Numerical Integration: Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rules.

UNIT 4 Numerical solutions of ordinary differential equations - 1 5 Hours

Picard's method, Taylor's series method, Euler's method, and Modified Euler's method

UNIT 5 Numerical solutions of ordinary differential equations - 2 5 Hours

Runge-Kutta method (second and fourth order), Predictor-Corrector methods-Adams-Bashforth and Milne's methods.

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.

References:

1. M.K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5/e, New Age International(P) Limited, 2007.
2. S.S. Sastry, Introductory methods of Numerical Analysis,4/e,PHI Learning Publications,2009.
3. H.C Saxena, Finite Differences and Numerical Analysis, Chand and Company Pvt. Ltd., New Delhi.

Course Outcomes:

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

1. analyze how root finding techniques can be used to solve practical engineering problems.
2. apply various interpolation techniques to solve practical problems .
3. apply numerical differentiation and integration whenever and wherever routine methods are not applicable .
4. solve differential equations using various numerical methods .
5. know the strengths and weaknesses of the various methods and be able to decide which ones are appropriate for a particular problem

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:

Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

<table>
<tr><td rowspan="2">MATH1021</td><td rowspan="2">TRANSFORM TECHNIQUES</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">MATH1031</td></tr>
<tr><td>Co- requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">Engineering and Science</td></tr>
</table>

Course Description:

This course is designed to impact the knowledge on (Laplace, Fourier) transforms and applications of these transforms on differential equations.

Course Educational Objectives:

1. To introduce and explain the concepts of Laplace transforms and properties.
2. To demonstrate the evaluation of Laplace transforms of special functions and additional properties.
3. To impart knowledge on obtaining Fourier series
4. To introduce and explain the concepts of Fourier transforms and properties.
5. To explain the evaluation of Fourier transforms of various function and then applications to boundary value problem.
6. To demonstrate and understand the transform techniques using available software

UNIT 1 Laplace transforms 5 Hours

Introduction, transforms of elementary functions, properties of Laplace transforms, transforms of derivatives, transforms of Integrals, Multiplication by t^n, Division by t.

UNIT 2 Applications of Laplace transforms 5 Hours

Evaluation of integrals by Laplace transforms, Inverse transforms, Solution of Differential equations.

UNIT 3 Fourier Series 6 Hours

Introduction, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval.

UNIT 4 Half-Range Fourier Series 3 Hours

Even and odd functions, Half range sine series, and Half range cosine series.

UNIT 5 Fourier transforms 7 Hours

Introduction, Fourier sine & cosine integrals, Fourier transforms, Properties of Fourier transforms-linear, change of scale & shifting property.

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

References:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel R. Hass, Thomas' Calculus, 13/e, Pearson Publishers, 2014.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson Publishers, 2011.

Course Outcomes:

At the end of the course students will be able to

1. find Laplace transform of a function along with properties.
2. evaluate the Laplace transform of special functions.
3. apply the Laplace transform for solving differential equations (continuous systems)
4. evaluate the Fourier transform of a function along with properties and solve boundary value problems by Fourier transforms.
5. evaluate the engineering problems using transform techniques with the help of advanced math software

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4
Ensure inclusive and equitable quality education and promote lifelong opportunities for all

SDG Justification:
Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH2381	OPERATIONS RESEARCH	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	**NIL**						
Co- requisite	**NIL**						
Preferable exposure	**Engineering and Science**						

Course Description:

Operations Research (OR), also known as management science, has become an indispensable tool in scientific management. Operations Research focuses on developing and analyzing strategic and tactical levels to aid in decision-making and decision-making on the operational level. The essential tools of OR are algorithms, procedures that create and improve solutions to a point at which optimal or, at least, satisfactory solutions have been found.

Course Educational Objectives:

This course is designed to:

1. introduce the fundamentals of Operations Research to the students at the undergraduate level
2. solve different types of optimization problems of various categories and applying modern methodologies in the area of optimization
3. help students to develop a deep understanding of the classical and numerical optimization techniques and problem-solving capabilities

UNIT 1 — Linear Programming — 4 Hours

Formulation of LPP, convex sets and their properties, slack and surplus variables, Basic solution, Basic feasible solution, non-degenerate and degenerate basic feasible solutions, optimal solution, General, Standard, and Canonical form of LPP.

UNIT 2 — Simplex Method — 8 Hours

Simplex method, Degeneracy in LPP, Artificial variables techniques-Two Phase method, Big M-method.

UNIT 3 — Duality — 5 Hours

Duality in linear programming, primal-dual relationships, weak duality theorem, strong duality theorem, and dual simplex method.

UNIT 4 — Integer Programming — 4 Hours

Gomory's cutting plane method, Branch and Bound method for solving integer linear programming problems

UNIT 5 — Sensitivity Analysis — 5 Hours

Introduction to sensitivity analysis, variations in the price vector, variations in the requirement vector, addition of a new decision variable to the existing problem.

Textbooks:

1. Operations Research by S.D.Sarma, Kedarnath, Ramnath and company, 15^{th} edition, 2008.
2. Operations Research An Introduction by Hamdy A. Taha, 8^{th} edition, Pearson, 2007.

References:

1. Linear Programming by R K Gupta, Krishna Prakashan Mandir, 13^{th} edition 2014.
2. Operations Research Theory and Applications by J K Sharma, 4th edition, Macmillan Publishers India Ltd, 2009

Course Outcomes:

On successful completion of this course, students will be able to:

1. understand the linear programming problem, its formation, and basic definitions of solutions
2. understand the simplex method, which is a very efficient algorithm to solve a linear programming problem
3. understand the dual primal relationship, properties of duality, and the dual simplex algorithm
4. find integer solutions to LPP by cutting plane methods
5. find variations in price and requirement vectors and retaining optimality

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:

Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH2301	COMPLEX VARIABLES	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	NIL						
Co- requisite	NIL						
Preferable exposure	Engineering and Science						

Course Description:

This course is designed to familiarize the students with complex analysis, nature of a series, evaluation of integrals using Cauchy's theorem.

Course Educational Objectives:

- To explain the concept of complex functions and analytic functions.
- To explain the concept of conformal mapping.
- To explain the concept of Cauchy's theorem and residue theorem.
- To explain the convergence of series such as Taylor's and Laurent.
- To explain the concept of Cauchy's theorem and residue theorem.

UNIT 1 **Functions of a Complex variable** **6 Hours**

Limit and continuity, Differentiation, Analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugates- applications to flow problems.

UNIT 2 **5 Hours**

Geometrical representation of f(z) – Some standard transformations – Bilinear transformation - Conformal mappings. Special conformal transformations ($w = z^2$, w= z+1/z , $w = e^z$, w= coshz)

UNIT 3 **Complex Integration** **5 Hours**

Integration of complex functions - Cauchy's theorem - Cauchy's integral formula.

UNIT 4 **Series representation of analytic functions** **5 Hours**

convergent series of analytic functions, Laurent 's and Taylor series, zeros and singularities of an analytic function

UNIT 5 **Calculus of residues** **5 Hours**

Residue -Cauchy Residue theorem – Calculation of residues (All theorems without proof).

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publishers, New Delhi, 2012.

References:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics Narosa Publishing House, New Delhi, 2014.
2. N. P. Bali and Manish Goyal, A Text Book of Engineering Mathematics, 8th Edition, Lakshmi Publications, New Delhi, 2012.

Course Outcomes:

1. Make use of differentiation and integration of complex functions in engineering problems.
2. Concept of conformal mappings .
3. Use Cauchy's theorem and Cauchy's integral formula to evaluate the line integrals
4. Apply Taylor's and Laurent's series to expand complex functions and know about the convergence region .
5. Evaluation of integrals using Residue theorem.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4
Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:
Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

<table>
<tr><td rowspan="2">MATH1041</td><td rowspan="2">DISCRETE MATHEMATICS</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Co- requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">Engineering and Science</td></tr>
</table>

Course Description:

Discrete Mathematics introduces students to the mathematics of networks, social choice, and decision making. This course provides students with a hands-on exploration of the relevancy of mathematics in the real world. This course reflects the rigor taught in many entry-level mathematics courses.

Course Educational Objectives:

1. To introduce basics of mathematical logical operators and connectives
2. To impart knowledge on normal forms and rules of inference.
3. To impart knowledge on partially ordered and total ordered sets.
4. To familiarize closed form solution of linear recurrence relations by various methods.
5. To impart knowledge on basic concepts of algebraic structures.
6. To write program structures, and understand when programming is most applicable

UNIT 1 **Logic Operators and Connectives** **5 Hours**

Negation, conjunction, disjunction, conditional and bi-conditional, well formed formulae, tautologies, equivalence of formulae, duality, tautological implications.

UNIT 2 **Mathematical logic** **5 Hours**

Conjunctive and disjunctive normal forms- principal disjunctive and conjunctive normal forms, Rules of inference for propositional calculus (Rule P, Rule T and CP rule).

UNIT 3 **Sets and Relations** **5 Hours**

Basic concepts of set theory, Power set, relations, properties of binary relations in a set, Equivalence relations, composition of binary relations, Partial ordering, Partially ordered set.Hasse diagram.

UNIT 4 **Recurrence relations** **5 Hours**

Recurrence relations, solving linear recurrence relations by characteristic roots method, system of recurrence relations.

UNIT 5 **Algebraic Structures** **6 Hours**

Algebraic Structures-Semi group, Monoid, Groups, subgroups, cosets (definition and examples) Lagrange's theorem on finite groups

Text Books:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1997.
2. Kenneth H. Rosen, Discrete Mathematics and Applications, Seventh edition, Tata McGrawHill,2012.

References:

1. Bhishma Rao, Mathematical Foundations of Computer Science, SciTech Publications (India) Pvt Ltd.
2. Discrete Mathematical Structures,Sixth edition-Kolman,Busby,Ross

Course Outcomes:

Upon successful completion of this course the student should be able to

1. Check the validity of a statement formula
2. analyze the concepts in set theory and relations
3. find a general solution of recurrence equation
4. build the algebraic structures and apply Lagrange’s theorem on finite groups
5. Convert problem solving strategies to procedural algorithms

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4
Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:
Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH1051	Graph Theory	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	**NIL**						
Co- requisite	**NIL**						
Preferable exposure	**Engineering and Science**						

Course Description:

This course introduces basic concepts in Graph Theory, including properties and characterization of graph/trees and graph theoretic algorithms, which are widely used in Mathematical modelling and has got applications across Computer Science and other branches in Engineering.

Course Educational Objectives:

1. To introduce basics of group theory and its applications
2. To impart knowledge on basic concepts of paths and circuits
3. To impart knowledge on Trees, spanning trees, shortest spanning trees
4. To familiarize in the matrix representation of graphs
5. To transform scientific problems into generic computational models

UNIT 1 Basics of graphs 5 Hours

Finite and Infinite Graphs, Incidence and Degree, Isolated Vertex, Pendant Vertex, and Null Graph, complete graph, Bi-partite and complete Bi-partite graphs.

UNIT 2 Matrix representation of graphs 5 Hours

Adjacency Matrix, Incidence Matrix, Path Matrix (Definition and examples)

UNIT 3 Paths and circuits 6 Hours

Paths, and Circuits, Connected Graphs, Disconnected Graphs, and Components, Euler Graphs, Hamiltonian graphs (Definition, examples and without proofs)

UNIT 4 Trees 5 Hours

Trees and their properties, spanning trees, minimal spanning trees, Kruskal's algorithm for finding a minimal spanning tree.

UNIT 5 Applications of Trees and Fundamental circuits 5 Hours

Preorder, in order and post order traversals, Prefix and Postfix notations of an arithmetic expression, parsing trees.

Textbooks:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1997.

2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India, 2006.

References:

1. Bhishma Rao, Mathematical Foundations of Computer Science, SciTech Publications (India) Pvt Ltd.
2. Kenneth H. Rosen, Discrete Mathematics and Applications, Seventh edition, Tata McGrawHill,2012.

Course Outcomes:

Upon successful completion of this course the student should be able to

1. analyse the concepts in graph theory
2. apply graph theory concepts in core subjects such as data structures and network theory effectively
3. Identify different types of paths
4. Construct minimum spanning tree using some algorithms and identify tree traversals
5. Solve the graphical problems which are accessed in available software

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4
Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:
Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH2311	NUMBER THEORY	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	**NIL**						
Co- requisite	**NIL**						
Preferable exposure	**Engineering and Science**						

Course Description:

This course is designed to explain the basics and applications of number theory for the students of Computer Science. The core courses of these branches encounter with concepts like prime factorization, modular arithmetic, and quadratic reciprocities in number theory. The first unit of the course provide a strong platform for such encounters and the other units focuses on applications of number theory.

Course Educational Objectives:

1. To teach basic concepts of number theory focusing on Computational aspects.
2. To teach the concepts of factorization of integers.
3. To teach Format's theorem and quadratic residues.
4. To explain Chines remainder theorem and Euclidean algorithm.
5. To explain polynomial arithmetic.

UNIT 1 **Basic Concepts in Number Theory** **5 Hours**

Topics in elementary number theory, Divisibility, Greatest Common Divisor, Euclidean Algorithm

UNIT 2 **5 Hours**

Fundamental theorem of Arithmetic, Congruences, Properties of congruences, Linear congruences

UNIT 3 **5 Hours**

Fermat's theorem, Fermat's little theorem, Wilson's theorem

UNIT 4 **5 Hours**

Chinese remainder theorem, The functions τ and σ, Euler Phi-function, Euler's theorem, Some properties of phi function

UNIT 5 **5 Hours**

The order of integer modulo n, Primitive roots for prime, Composite number having primitive roots

Textbooks:

1. Elementary Number Theory | 7th Edition by David Burton, Mc Graw Hill Education

References:

1. Basic Number Theory by S.B. Malik,S. Chand publishers

Course Outcomes:

Upon successful completion of this course the student should be able to

1. Apply concepts of number theory focusing on Computational aspects.
2. Analyze concepts of factorization of integers.
3. Explain Fermat's theorem and quadratic residues.
4. Analyse Chines remainder theorem and Euclidean algorithm.
5. Analyse the concept of polynomial arithmetic.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4
Ensure inclusive and equitable quality education and promote lifelong opportunities for all.
SDG Justification:
Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

<table>
<tr><td rowspan="2">MATH2291</td><td rowspan="2">LINEAR ALGEBRA</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Co- requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">Engineering and Science</td></tr>
</table>

Course Description:

This course is designed to gain knowledge in the concepts of Linear Algebra focusing on basics of matrices, vector spaces and singular value decomposition to understand the basic concepts of Linear Algebra in the applications of image processing and machine learning.

Course Educational Objectives:

1. To familiarize with theory of matrices and tools for solving system of linear equations
2. To impart knowledge on Eigen values and Eigen vectors.
3. To teach basic concepts of vector spaces and their properties.
4. To explain the concepts of inner product spaces.
5. To familiarize with concept of singular value decomposition and its applications

UNIT 1 Fundamentals of Matrices 5 Hours

Introduction to Matrices and Rank of a matrix, Echelon form, solving system of linear equations.

UNIT 2 Eigen values and Eigen vectors 5 Hours

Eigen values and Eigen vectors, positive definite matrices, Linear dependence, and Linear independence.

UNIT 3 Vector Spaces 6 Hours

Vector space, linear combination of vectors, linear span, basis and dimension, linear Transformation.

UNIT 4 Inner Product Spaces 5 Hours

Inner Product Spaces, examples of inner product spaces, norm and length of a vector cauchy-schwarz's inequality.

UNIT 5 Singular value decomposition 5 Hours

Singular values, computing singular value decomposition and Introduction to principal component analysis.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal.
2. Linear Algebra, Schaum's Outline,4th edition, Seymour Lipchutz,Marc Lipson

References:

1. Advanced Engineering Mathematics, 7th Edition, Peter V. O'Neil.
2. Advanced Engineering Mathematics, 2nd Edition, Michael. D. Greenberg.
3. Introduction to linear algebra, 5th Edition, Gilbert Strang.
4. Applied Mathematics (Vol. I & II), by P. N. Wartikar& J. N. Wartikar.
5. Digital Image Processing, R C Gonzalez and R E Woods.

Course Outcomes:

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

- solve the system of linear equations
- calculate Eigen values and Eigen vectors
- find the basis
- learn Singular value decomposition
- learn principal Component analysis

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:

Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems.

<table>
<tr><td rowspan="2">MATH2341</td><td rowspan="2">PROBABILITY THEORY AND RANDOM VARIABLES</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Co- requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">Engineering and Science</td></tr>
</table>

Course Description:

To expose the students to the basics of probability theory and random processes essential for modelling and quantifying uncertainties and noise in systems

Course Educational Objectives:

- To know about various random life length models and their uses in finding the reliability of different electronic devices.
- To learn about basic properties and characteristics of various random processes with reference to signal and trunk processes.

UNIT 1 Probability 5 Hours

Axioms of probability theory. Probability spaces. Joint and conditional probabilities. Bayes' Theorem- Independent events.

UNIT 2 Random Variable 5 Hours

Random variables and random vectors. Distributions and densities. Independent random variables. Functions of one and two random variables.

UNIT 3 Multiple Random Variables 6 Hours

Vector random variables, joint distribution and density functions, properties, conditional distribution and density, statistical independence, distribution and density of a sum of random variables, central limit theorem.

UNIT 4 Expected Value of a Function of Random Variables 6 Hours

Joint moments about the origin, joint central moments, jointly Gaussian random variables - two random variables case, N random variable case.

UNIT 5 Random Process 6 Hours

Temporal characteristics - the random process concept, stationarity and statistical independence, correlation functions, Gaussian random processes, Poisson random process.

Textbooks:

1. Peyton Z. Peebles, Probability, Random Variables and Random Signal Principles, 4/e, Tata McGraw Hill, 2002.
2. Athanasios Papoulis, S. Unnikrishnan Pillai, Probability, Random Variables and Stochastic Processes, 4/e, Tata McGraw Hill, 2002.

References:

1. Simon Haykin, Communication Systems, 4/e, Wiley Student Edition, 2006.
2. Henry Stark, John W. Woods, Probability and Random Processes with Application to Signal Processing, 3/e, Pearson Education, 2002.

Course Outcomes:

Upon successful completion of this course, the student should be able to

1. Analyze the outcomes of random experiments and develop the concept of random variables and obtain probabilities through them
2. define single random variables in terms of their PDF and CDF, and calculate moments such as the mean and variance
3. explore the random experiments specified by multiple random variables and study the Distribution of them
4. apply the fundamentals of probability theory and random processes to practical engineering problems
5. identify and interpret the key parameters that underlie the random nature of the problems

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:

Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH2321	RANDOM PROCESSES	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	**NIL**						
Co- requisite	**NIL**						
Preferable exposure	**Engineering and Science**						

Course Description:

This course is designed to impart knowledge on random processes needed in applications such as signal processing, digital communications, speech processing, data modelling, etc.

Course Educational Objectives:

1. To familiarize the students in the concepts of probability and random variables.
2. To study Random Processes, its types, distribution, and density functions.
3. To study Gaussian and Poisson processes.
4. To apply random process to signal processing in communication systems.
5. To apply skills in analysing random phenomena which occur in Electrical and Electronics Engineering applications.

UNIT 1 **Random Processes** **6 Hours**

Temporal characteristics - the random processes concept, Classification of random processes, stationarity and statistical independence. Time averages and Ergodicity.

UNIT 2 **Correlation and Covariance functions** **5 Hours**

Auto correlation, Cross correlation, Properties. Covariance functions. Gaussian random processes, Poisson random processes

UNIT 3 **Density functions** **5 Hours**

Probability density and joint probability density functions, Properties.

UNIT 4 **Spectral densities functions - I** **5 Hours**

Spectral characteristics, the power density spectrum: Properties, relationship between power density spectrum and autocorrelation function.

UNIT 5 **Spectral densities functions-II** **5 Hours**

Cross-power density spectrum, Properties, relationship between cross power spectrum and cross-correlation function.

Textbooks:

1. Peyton Z. Peebles, Probability, Random Variables and Random Signal Principles, 4/e, Tata McGraw Hill, 2002.

References:

1. Athanasios Papoulis, S. Unnikrishnan Pillai, Probability, Random Variables and Stochastic Processes, 4/e, Tata McGraw Hill, 2002.
2. Simon Haykin, Communication Systems, 4/e, Wiley Student Edition, 2006.
3. Henry Stark, John W. Woods, Probability and Random Processes with Application to Signal Processing, 3/e, Pearson Education, 2002.

Course Outcomes:

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

- solve the problems on multiple random variables, joint distribution and independence
- solve the problems Gaussian and Poisson processes
- understand the concept of random processes
- determine covariance and spectral density of stationary random processes
- characterize the random signals in communication systems with their autocorrelation and power spectral density functions

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4
Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:
Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH2351	OPTIMIZATION METHODS	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	NIL						
Co- requisite	NIL						
Preferable exposure	Engineering and Science						

Course Description:

Optimization is the art of finding the best result under given conditions. In this fast-expanding world, an engineer has to use many Optimization methods, as it is the most significant in decision-making, design, manufacturing, maintenance, planning, and scheduling.

Course Educational Objectives:

This course is designed to:

- introduce various optimization methods for solving real-world problems
- find optimal solutions to transportation, assignment, and sequencing problems
- know project planning and scheduling
- study the network analysis techniques through CPM and PERT

UNIT 1 Transportation Problem 6 Hours

Introduction and LP formulation of Transportation Problem, feasible solution, basic feasible solution, finding Initial basic feasible solutions by North West corner rule, Least-cost entry method, Vogel's approximation method, Transportation Algorithm (MODI Method) to find an optimal solution.

UNIT 2 Assignment Problems 5 Hours

Introduction to Assignment Problem, Mathematical formulation, Hungarian Method for finding optimal solution, unbalanced assignment problem, Travelling Salesman Problem.

UNIT 3 Sequencing Problem 4 Hours

Introduction, Basic terminology, Algorithms to obtain optimal solutions for sequencing problems with n jobs and two machines and n jobs and k machines.

UNIT 4 Network Analysis in Project planning 4 Hours

Project, Project Planning, Project Scheduling, Project Controlling, Work breakdown structure, Network Techniques, terms used in network-activity, event, path, network, dummy activity, looping, Fulkerson's rule, network diagram, and activity on node diagram.

UNIT 5 PERT and CPM 7 Hours

Critical path method (CPM), Measure of activity, Critical path analysis, the four floats, subcritical and supercritical activities, slack, Programme evaluation and review technique (PERT), time estimates, frequency distribution curve for PERT

Text Books:

1. Operations Research by S.D.Sarma, Kedarnath, Ramnath and company, 15th edition, 2008.
2. Operations Research An Introduction by Hamdy A. Taha, 8th edition, Pearson, 2007.

References:

1. Linear Programming by R K Gupta, Krishna Prakashan Mandir, 13th edition 2014.
2. Operations Research Theory and Applications by J K Sharma, 4th edition, Macmillan Publishers India Ltd, 2009

Course Outcomes:

On successful completion of this course, students will be able to:

1. apply MODI method for finding optimal transportation cost
2. apply Hungarian Method for solving assignment problems and finding an optimal route to the salesman
3. understand the process of finding optimal sequencing for processing jobs on machines
4. understand the network terminology and construction
5. apply CPM and PERT techniques for project management

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4
Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:
Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH2331	COMPUTATIONAL METHODS	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	**NIL**						
Co- requisite	**NIL**						
Preferable exposure	**Engineering and Science**						

Course Description:

This course is designed for Aerospace Engineering undergraduate students. It is designed for the students for the basic understanding of techniques for numerical solution of algebraic equations, differentiation, integration used to solve aerospace engineering application problems.

Course Educational Objectives:

1. Develop the mathematical skills in the areas of numerical methods.
2. Focus on the theory and applications of numerical methods in many engineering subjects which require solutions of linear systems, finding eigenvalues, eigenvectors, Interpolation, and applications, solving ODEs, PDEs.
3. Help in the foundation of computational mathematics for postgraduate courses, specialized studies, and research.
4. Train in developing the codes for implementing the numerical methods using any programming languages.
5. Formulate a mathematical model for a given engineering problem

UNIT 1 Mathematical Modeling of Engineering Problems 5 Hours

Approximations: Accuracy and precision, round-off and truncation errors, error problem with example problems. **Roots of Equations:** Formulations of linear and non-linear algebraic equations, solution with bisection, Newton-Raphson and Secant methods. Application to practical problems. **Algebraic Equations**: Formulation of linear algebraic equations from engineering problems, solution of these problems by Gauss elimination method, pitfalls of elimination and techniques for improving the solutions, Gauss Seidel iteration for solving sparse equations by avoiding storage of zero coefficients in matrix, convergence of iteration methods. LU decomposition methods for symmetric (Chelosky) matrices.

UNIT 2 Eigenvalues and Eigenvectors Problems 5 Hours

Formulation of equations to column, truss, spring-mass and friction problems. Solutions for the largest and smallest eigenvalues and corresponding eigenvectors. **Interpolation Methods:** Polynomial interpolation, Lagrange interpolation polynomials with equi- spaced data. **Regression or Curve Fitting:** Linear regression by least squares method.

UNIT 3 **Initial Value Problems** **6 Hours**

Ordinary differential equations, Euler, Heun's and Ralston methods. Runge- Kutta method of 2nd and 4th order, application to vibration and heat transfer problems. **Boundary Value Problems:** Linear and nonlinear ordinary differential equations, boundary value problems over semi-infinite domain, solution of nonlinear equations by finite difference method.

UNIT 4 **6 Hours**

Laplace Equations: Finite difference discretization of computational domain, different types of boundary conditions, solution to elliptic equations. **Parabolic Transient Diffusion Equations:** Explicit and implicit formulation, Crank Nicolson Method.

UNIT 5 **Numerical Integration** **6 Hours**

Trapezoidal, Simpson's 1/3 and 3/8 rule and Gauss quadrature method.

List of Computational Exercises:

1. Determine the real root for a given polynomial equation by (i) Bisection, (ii) Newton-Raphson until the approximate error falls below 0.5%.
2. Solve the system of simultaneous linear equations by
   i. Naïve -Gauss elimination
   ii. Gaussian elimination with partial pivoting
   iii. Gauss -Seidel method.
   iv. LU decomposition
3. Implement power method to find Eigenvalues and Eigenvectors for Spring mass system
4. Solve the parabolic partial differential equations by using explicit, implicit and semi-implicit methods
5. Solve the elliptic partial differential equations by finite difference techniques.
6. Finding the integral for a second-order polynomial using Gauss quadrature formula.
7. Solve numerical differentiation problems using Runge-Kutta 2nd and 4th order methods.
8. Find the integral by numerical methods such as Trapezoidal and Simpson's rule.

Textbooks:

1. S.P. Venkateshan, P. Swaminathan, Computational Methods in Engineering, 1/e, Ane Publisher, 2014.
2. S.C. Chapra, R.P. Canale, Numerical Methods for Engineers, 6/e, Tata McGraw-Hill, 2012.

References:

1. S.K. Gupta, Numerical Methods for Engineers, 1/e, New Age International, 2005

Course Outcomes:

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

1. Demonstrate understanding of common numerical methods and how they are used to

obtain approximate solutions to otherwise intractable mathematical problems.
2. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
3. Analyse and evaluate the accuracy of common numerical methods.
4. Implement numerical methods using any programming language (matlab, scilab, python…)
5. Write efficient, well-documented code and present numerical results in an informative way.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4
Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:
Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH1061	Introduction to Mathematics - I	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	NIL						
Co- requisite	NIL						
Preferable exposure	Engineering and Science						

Course Description:

This course is designed to introduce the mathematics required for basic physics, engineering mathematics, and introductory engineering courses.

Course Educational Objectives:

- To explain the concepts of Trigonometry.
- To explain the basic concepts of differentiation and differential equations
- To teach the evaluation of definite and indefinite integrals.
- To explain the basic concepts of differential equations, multivariable and vector calculus

UNIT 1 : Representations , Co-ordinate systems and Trigonometry 3 Hours

Representations for Scalars, Vectors, Matrices and Tensors. Coordinate systems: cartesian and polar coordinate systems.

Trigonometry: Trigonometric functions, Periodicity, Trigonometric Ratio of Compound angles, multiple and sub multiple angles, transformations, brief introduction of inverse trigonometric, hyperbolic and inverse hyperbolic functions.

UNIT 2 Differential Calculus 3 Hours

Limits and Continuity: Definition of right hand limit, left hand limit, standard limits

(without proofs), definition of continuity and simple illustrations.

Differentiation: Introduction, definition, differentiation of a function at a point and on an interval, derivative of a function, differentiation of sum, difference, product and quotient of functions, differentiation of algebraic, exponential, logarithmic functions, composite, implicit, parametric, hyperbolic, inverse hyperbolic functions, derivatives of first and second order.

UNIT 3 Integration 8 Hours

Indefinite Integrals: Integration as the inverse process of differentiation, standard forms, properties of integrals, integration by the method of substitution covering algebraic, trigonometric, exponential functions, integration by parts, logarithmic functions, inverse trigonometric functions.

Definite Integrals: Definition of a definite integral and its properties (without proof)

UNIT 4 Introduction to differential equations , Multivariable calculus, and Vector Calculus 8 Hours

Differential Equations : Order and degree of a ordinary differential equations, Formation of ordinary differential equations

Multivariable Calculus : Limits and continuity of functions of two or more variables, Partial derivates, Total derivates(without problems)

Vector Calculus : Gradient, Divergence and Curl (with simple problems), Introduction to line, surface and volume integrals (without problems) illustrated with Stokes, Gauss, and Green's theorems (Only statements).

Textbooks:

1. Text book for Intermediate Mathematics, Board of Intermediate Education, AP, Volumes IA, IB & IIA, 2018.
2. NCERT class XI and XII (part 1) Mathematics text books.
3. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

References:

1. V. Venkateswara Rao, N. Krishna Murthy, B.V.S.Sharma, Intermediate Mathematics, S.Chand & Company Ltd., Volume I & II.
2. Chandrika Prasad, A first Course in Mathematics.
3. Text book for Intermediate Mathematics, Deepti Publications.

Course Outcomes:

After the completion of the course the student should be able to

- solve problems involving trigonometric functions
- understand the principles of differential calculus
- evaluate integration using various techniques
- understand the basic concepts of ordinary differential equations,
- understand the basic concepts of multivariable and vector calculus

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:

Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH1071	INTRODUCTION TO MATHEMATICS - II	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	NIL						
Co- requisite	NIL						
Preferable exposure	Engineering and Science						

Course Description:

This course is designed to introduce the mathematics required for basic physics, engineering mathematics, and introductory engineering courses.

Course Educational Objectives:

1. To describe the basic concepts of matrices
2. To introduce complex numbers and their properties.
3. To teach the techniques based on partial fractions
4. To explain the concepts of straight lines and circles
5. To impart knowledge on solid geometry.
6. To demonstrate the solution of a problem using computational

UNIT 1 Matrices 6Hours

Matrices, determinants, definition, types of matrices, algebra of matrices, properties of determinants of 2 X 2, 3 X 3 matrices, inverse of a matrix, solving simultaneous linear equations in two and three variables using matrix inverse method, Cramer's rule and Gauss Jordan method. Eigenvalues and Eigenvector of matrices.

UNIT 2 Complex Numbers 6 Hours

Complex number as an ordered pair of real numbers, representation of z □ (a, b) in the form (a + ib) conjugate complex numbers, modulus and amplitude of a complex number, geometrical representation of a complex number, Argand diagram.

UNIT 3 Partial Fractions 6 Hours

Introduction, resolving g(x) into partial fractions when g(x) contains non repeated linear factors, repeated linear factors, repeated and non-repeated irreducible quadratic factors.

UNIT 4 Co-ordinate Geometry 6 Hours

Straight lines: General equation of a straight line,line passing through the point of intersection of two given lines, angle between two intersecting lines, condition for perpendicularity and parallelism, length of the perpendicular from a point to a straight line, distance between two parallel lines (without proofs).

Circles: Equation of a circle, centre and radius, equation of a circle through three non collinear points, parametric equations of a circle.

Unit V Solid Geometry **6 hours**

Solid Geometry: Equation of a plane, Intersection of two planes, Equation of a sphere in spherical and cartesian coordinates, Intersection of a plane and a sphere.

Textbooks:

1. Textbook for Intermediate Mathematics, Board of Intermediate Education, AP, Volumes IB, IIA & IIB, 2018.
2. NCERT class XI and XII (part 1 & 2) Mathematics text books.

References:

1. V. Venkateswara Rao, N. Krishna Murthy, B.V.S. Sharma, Intermediate Mathematics, S. Chand & Company Ltd., Volume I & II.
2. Chandrika Prasad, A first Course in Mathematics.
3. Text book for Intermediate Mathematics, Deepti Publications.

Course Outcomes:

After the completion of the course the student should be able to

1. describe the properties of matrices
2. describe the properties of complex numbers
3. find a fractional function and resolve it into partial fractions
4. illustrate straight-line and circle properties and describe different regions in different co-ordinate systems
5. illustrate the procedure to solve a problem using math software

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:

Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

MATH2361	PROBABILITY AND STATISTICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	NIL						
Co- requisite	NIL						
Preferable exposure	Engineering and Science						

Course Description:

Probability theory is important when it comes to evaluating statistics. This course treats the most common discrete and continuous distributions, showing how they use in decision and estimation problems, and constructs computer algorithms for generating observations from the various distributions.

Course Educational Objectives:

1. To familiarize the students with the foundations of probability and statistical methods
2. To impart concepts in probability and statistical methods in engineering applications.

UNIT 1 Data Science and Probability 10 Hours

Data Science: Statistics introduction, Population vs Sample, collection of data, primary and secondary data, types of variables: dependent and independent Categorical and Continuous variables, data visualization, Measures of central tendency, Measures of dispersion (variance).

Probability: Probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem (without proof).

UNIT 2 Random Variable and Probability Distributions 8 Hours

Random variables (discrete and continuous), probability density functions, probability distribution - Binomial, Poisson and normal distribution-their properties (mathematical expectation and variance).

UNIT 3 Correlation, Regression and Estimation 8 Hours

Correlation, correlation coefficient, rank correlation, regression, lines of regression, regression coefficients, principle of least squares and curve fitting (straight Line, parabola and exponential curves). **Estimation:** Parameter, statistic, sampling distribution, point estimation, properties of estimators, interval estimation.

UNIT 4 Testing of Hypothesis and Large Sample Tests 8 Hours

Formulation of null hypothesis, alternative hypothesis, the critical region, two types of errors, level of significance, and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

UNIT 5 Small Sample Tests 6 Hours

Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), χ2 - test for goodness of fit, χ2 - test for independence of attributes.

Textbooks:

1. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

References:

1. S. Ross, A First Course in Probability, Pearson Education India, 2002.
2. W. Feller, An Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.

Course Outcomes:

Upon successful completion of this course, the student should be able to

1. classify the concepts of data science and its importance
2. apply discrete and continuous probability distributions
3. explain the association of characteristics through correlation and regression tools
4. identify the components of a classical hypothesis test
5. infer the statistical inferential methods based on small and large sampling tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 26-04-2021 ACADEMIC COUNCIL: 17-09-2021

SDG No. & Statement: 4

Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

SDG Justification:

Learning of various mathematical techniques will lead to knowledge of applications in Engineering problems

<table>
<tr><td rowspan="2">MECH1011</td><td rowspan="2">ENGINEERING VISUALIZATION AND PRODUCT REALIZATION</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">Nil</td></tr>
<tr><td>Co- requisite</td><td colspan="7">3D Printing</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">Fusion 360 Additional Modules</td></tr>
</table>

Course Description:

This course introduces basic engineering drawing concepts such as projections, sectional views, and utility of drafting and modelling packages. The course imparts the knowledge of modelling and assembling of components using CAD software. The course also includes preparation of 3D models using 3D printing. The modules and topics mentioned in this course are designed to ensure all-inclusive and thorough education with equity to all persons and always promote learning opportunities.

Course Educational Objectives:

1. To create awareness of engineering drawing as relevant to industry standards.
2. To improve visualization abilities essential for successful engineering design.
3. To impart 2D sketching and 3D modeling using the relevant software.
4. To teach assembly drawing and simulation of motion between mating components.
5. To introduce basic 3D printing software for preparing the products for printing.

List of experiments:

1. Manual Drawing: Introduction to Engineering graphics: Principles of Engineering Graphics and their significance, conventions in drawing lettering, BIS Conventions, Dimensioning, Sectional Views
2. Free hand sketching, Free hand sketching of isometric & orthographic views and interpretation of drawings.
3. Computer Aided Drafting, Introduction to CAD software: Basic draw and Modify commands in 2d
4. Introduction to 2D and 3D modelling using CAD packages
5. Assembly drawings, Assembly of individual 3D components, animation of motion
6. Coordinating multiple moving parts under joint constraints.
7. 3D printing, Introduction to 3D printing software, slicing.
8. Grading and rendering of simple geometries using software.

List of Projects:

Any one project among the following can be opted by the student and submitted:IC Engine Model (3D printed mini model)

- Belt Drive for a bike
- Four Wheel Drivable
- ATV Robot
- Toy making
- Carrom board
- Chess board and pieces model toy train,
- Avengers
- Building Bridges dams etc.,
- Wind Turbine Model etc
- Design of Radar and 3D Printing of Radar
- Models' Programmable logic Controllers –PLC
- Arduino Board Design and 3D Printing of Enclosures for Arduino Boards
- Design of mini mother boards

Text Books:

1. N D Bhatt, 'Engineering Drawing',53,Charotar Publishers, Gujarat India,2019,9789380358963
2. Lydia Sloan Cline,'Fusion 360 for Makers: Design Your Own Digital Models for 3D Printing and CNC Fabrication – Import, 5 June 2018 ',1,Make Comm**UNIT** y LLC,USA,2018,9781680456509

References:

1. Randy Shih,'Parametric Modeling with Autodesk Fusion 360 ',(Spring 2021 Edition),SDC Publications,Squibb Road Mission, KS,2021,1630574376, 9781630574376

Online Resources:

1. Introduction-to-parametric-modeling. 14, 2021, 1:27 p.m., https://www.ascented.com/courseware/product/autodesk-fusion-360--introduction-to-parametric-modeling
2. PP Song et al.,,'https://www.researchgate.net/publication/325189986_Research_and_Application_of_Autodesk_Fusion360_in_Industrial_Design', 2018,8

Course Outcomes:

1. Prepare drawings as per international standards.
2. Utilize Engineering visualization as Language of Engineers.
3. Sketch 2D models using CAD software
4. Sketch 3D models using CAD package.
5. Develop model for printing simple objects using 3D printer

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1	1	2							3	1	1
CO2	3	3		2	1	3	1		2	1	1		2	2	1
CO3	2	3		3	1	2			2	1	2		3	2	1
CO4	2	3		3	1	3							3	2	2
CO5	3	3	3	3	3	3		2		3	3	1	3	2	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:
SDG 4 - ensure all-inclusive and thorough education with equity to all persons and always promote learning opportunities.
SDG-9 engineers build resilient infrastructure which promote inclusive and sustainable industrialization and foster innovation***.***
SDG Justification:
SDG 4-The modules and topics mentioned in this course are designed to ensure all-inclusive and thorough education with equity to all persons and always promote learning opportunities.
SDG 9-The modules and topics mentioned in this course are designed to ensure the engineers build resilient infrastructure which promote inclusive and sustainable industrialization and foster innovation.

<table>
<tr><td rowspan="2">MECH1041</td><td rowspan="2">TECHNOLOGY EXPLORATION & PRODUCT ENGINEERING</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">None</td></tr>
<tr><td>Co-Requisite</td><td colspan="7">Engineering Visualization and Product Realization</td></tr>
<tr><td>Preferable Exposure</td><td colspan="7">Power tools and Basic Electronics</td></tr>
</table>

Course Description:

This is a fundamental engineering course that introduces the incoming students to hands-on product development experience using a combination of Mechanical Engineering and IoT concepts, programming with application of EVPR concepts and exposure to project planning.

Course Educational Objectives:

- Inculcate creativity, critical thinking and problem-solving skills with hands-on approach to all incoming freshmen.
- Emphasise product development using systems engineering approach.
- Impart multidisciplinary project-based skills with a combination of IoT, Programming, Simulation, Mechanisms and Machining.
- Involve Ideation to develop a variety of solutions to a problem statement rather than performing a standard job/experiment.
- Project planning and management to deliver the assigned project within the timeline.

SYLLABUS

- Manufacturing economics
- Evaluation of manufacturing strategies
- OBHS (Operational Behaviour, health, safety in hazardous environment)
- Power tools operations and safety – Angle grinder (Cutting, Grinding and Polishing), Driller and Jigsaw.
- Basics of Microprocessors and Microcontrollers
- General Introduction to Arduino, Node MCU, and Raspberry Pi.
- Basics of Electronics: General Introduction to the usage of Breadboard, Digital Multimeter, General Connections, Usage of Resistors, Capacitors, LEDs.
- Basics of Arduino & Node MCU coding – Libraries, board & port selection, baud rate, Basics of Troubleshooting, Cloud Interfacing etc.
- Usage and Applications of Basic Sensors: Ultrasonic, Voltage/Current, Temp/Humidity, Gas, IR
- Basics of Electromagnetism – Permanent Magnet DC Motor (PMDC), Brushless DC Motor (BLDC), Stepper and Servo Motors.

- Basics of Drawing/Circuit Simulation - Line diagram, Tinker CAD, Multisim, PROTEUS
- Basics of Mechanisms - Linear motion, Cam mechanism, Belt drive, gears
- Demonstration of Carpentry, Tin smithy, Fitting, Welding and Injection Moulding.
- Problem identification and understanding the needs of the users
- Project management and planning.

Project: All students must work in teams to complete a product/prototype of a given problem statement with the topics covered in the class.

Textbooks:

1. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, Internet of Things, Wiley India, 2019
2. Simon Monk, Programming Arduino: Getting Started with Sketches, Mc Graw Hill Publications, 2011

References:

1. Essaid, a. (2019). 507 Mechanical Movements: Mechanisms and How They Work (Dover Science Books). (n.p.): Independently Published.

Course Outcomes

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

1. Perform basic mechanical operations with power tools.
2. Understand and apply IoT concepts to drive mechanical components.
3. Apply multidisciplinary skills to solve practical engineering problems.
4. Conceptualize and work towards the creation of physical products.
5. Think along the lines of innovation and entrepreneurship.

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1									1			3	2	1	1
CO2	3	3	3		1							2	1	1	1
CO3	2	3	3	1	1	1			3	2	3	1	2	1	1
CO4	3	3	3	1	1	1	1	1	1	3	3		2	1	1
CO5													2	1	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 21-04-2023 **ACADEMIC COUNCIL: 19-06-2023**

SDG No. & Statement:

SDG 4: Ensure all-inclusive and thorough education with equity to all persons and always promote learning opportunities.

SDG 9: Engineers build resilient infrastructure which promote inclusive and sustainable industrialization and foster innovation.

SDG Justification:

SDG 4: The modules and topics mentioned in this course are designed to ensure all-inclusive and thorough education with equity to all persons and always promote learning opportunities.

SDG 9: The modules and topics mentioned in this course are designed to ensure the engineers build resilient infrastructure which promote inclusive and sustainable industrialization and foster innovation.

MECH1001	DESIGN THINKING	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**Nil**						
Co- requisite	**Nil**						
Preferable exposure	**Nil**						

Course Pre-requisite(s): Engineering Visualization and Product Realization

Course Description:

Design is a realization of a concept or idea into a configuration, drawing or product. Design Thinking is the cognitive and practical process by which design concepts are developed by designers. Innovation is a new idea or a new concept. Product development is the creation of a new or different product that offers new benefits to the end-user. This course introduces design thinking in product innovation.

Course Educational Objectives:

1. To familiarize the product design process
2. To introduce the basics of design thinking
3. To bring awareness on idea generation
4. To familiarize the role of design thinking in services design

Topic	Type
Each member of the group has to ask (vocally) the group members different questions about a product that they would like to design. Write down the questions and answers and submit as a word or pdf document.	Exercise
Each member of the group must ask (vocally) the group members questions about the product chosen in the previous experiment. This helps to gain indepth insights as well as new findings and information in order to grasp the problem or situation holistically or simply to find relevant questions for an interview. Write down the questions and answers and submit as a word or pdf document	Exercise
Identify relevant factors of influence that constitute the basis for a new or improved product or offer; then analyze it in a targeted manner. ➢ Make sure that you are sufficiently creative in the analysis process, because the focus is on technical “details”. ➢ Boost the efficiency of the analysis process by avoiding empty runs. ➢ Make use of a standardized procedure in order to examine the problem and solution space again with the help of data.	Exercise
➢ Do research, talk with people, and have empathy to formulate profound stories. ➢ Summarize the results from the “understand” and “observe” phases and discuss with the team.	Exercise

➢ Highlight unexpected results and generate new perspectives. ➢ In general, share insights, ideas, and results (solutions) with others. ➢ Explore untapped market opportunities. ➢ Provide differentiated and new offers based on the user needs. ➢ Adapt a strategy to new market needs by understanding the competitive edge. ➢ Establish the right vision for the design challenge or a road map for stepby-step implementation and control mechanisms.	Exercise
➢ Find out at an early stage whether the basic need is satisfied and the product attracts interest on the market. ➢ Find out through iterative testing whether the user need is met with a minimally functional product and how the product should be enhanced. ➢ Find out through user feedback how much demand there is for the product before developing further details and features. ➢ Minimize the risk of investing in a solution for which there is little demand on the market, thus saving time, money, and energy.	Exercise
➢ Perform a true A/B test or several variants of a prototype in the form of a multi-variants test or as split testing. ➢ Do a quantitative evaluation. ➢ Carry out a qualitative survey and evaluate the number and content of feedbacks. ➢ Compare individual variants of a function or a prototype (e.g. buttons, visuals, arrangement).	Exercise
➢ Collect and appraise experiences made in the project in a structured manner. ➢ Learn from experience and make use of it in the next project. ➢ Facilitate a positive attitude toward mistakes and appreciate progress. ➢ Identify and document the findings; make them applicable and usable.	Exercise
Case Studies: Example : Software Prototyping, Additive Manufacturing; Design of Arduino Boards for various applications etc	Exercise

Text Books:

1. Pahl, Beitz, Feldhusen, Grote,'Engineering Design: a systematic approach',3rd,Springer Science & Business Media,London,2007,978-1846283185
2. Christoph Meinel,Larry Leifer,Hasso Plattner,'Design Thinking Understand – Improve – Apply',1st,Springer,Berlin, Heidelberg,2011,978-3-642-13756-3

References:

1. Marc Stickdorn, Jakob Schneider,'This is Service Design Thinking: Basics, Tools, Cases',1st,WILEY,United States,2012,978-1-118-15630-8

Course Outcomes:

1. Innovate new methods in product development

2. 2 Apply Design Thinking in developing the new designs
3. Select ideas from ideation methods in new product development
4. Use Design Thinking in developing software products
5. Apply principles of Design Thinking in service design

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1	1	2							3	1	1
CO2	3	3		2	1	3	1		2	1	1		2	2	1
CO3	2	3		3	1	2			2	1	2		3	2	1
CO4	2	3		3	1	3							3	2	2
CO5	3	3	3	3	3	3		2		3	3	1	3	2	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS: 29-4-2021 **ACADEMIC COUNCIL: 17-9-2021**

SDG No. & Statement:
SDG 9
The modules and topics mentioned in this course are designed to ensure the engineers build resilient infrastructure which promote inclusive and sustainable industrialization and foster innovation.
SDG Justification:
The course involves design aspects

<table>
<tr><td rowspan="2">PHYS1001</td><td rowspan="2">PHYSICS</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>2</td><td>1</td><td>2</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Co- requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">NIL</td></tr>
</table>

Course Description:

This course is designed with fundamentals of electromagnetism and properties of materials for advanced courses in their respective engineering branches. It introduces electromagnetic theory with relevant mathematical tools, optical fibres and their propagation characteristics, properties of dielectric and magnetic materials. It also introduces principles of semiconductors and some widely used semiconductor devices for various applications.

Course Educational Objectives:

1. To introduce mathematical principles to estimate forces, fields and waves.
2. To familiarize students with electromagnetics in modern communication systems.
3. To impart knowledge concerning the electrical behaviour of dielectric materials.
4. To demonstrate the properties of magnets.
5. To introduce semiconductor physics and devices.

UNIT 1 Basics of Electromagnetics 9 Hours

Electrostatic field: Coulomb's law and Gauss 'law, derivation of Coulombs law from Gauss' law, applications of Gauss' law (line charge, thin sheet of charge and solid charged sphere), Gauss' law of electrostatics in dielectric medium, divergence and curl of electric fields, electric potential, relation between potential and force, Poisson's and Laplace equations. Magnetostatic field: Biot–Savarts' law, divergence and curl of magnetic fields, Faraday's and Ampere's laws in integral and differential form, displacement current, continuity equation, Maxwell's equations.

UNIT 2 Fiber Optics 7 Hours

Introduction, advantages of optical fibers, principle and structure, acceptance angle, numerical aperture, modes of propagation, classification of fibers, fiber optic communication, importance of V-number, fiber optic sensors (Temperature, displacement and force), applications.

UNIT 3 Dielectric, Magnetic and superconducting Materials 10 Hours

Dielectric materials: Introduction, electric polarization, dielectric polarizability, susceptibility and dielectric constant, types of polarizations (qualitative treatment only). Magnetic materials: Introduction, magnetic dipole moment, magnetization, magnetic susceptibility and permeability, origin of permanent magnetic moment, classification of magnetic materials, Weiss theory of ferromagnetism (qualitative), domain theory, hysteresis, soft and hard magnetic materials.

Superconductivity: definition –Meissner effect –type I & II superconductors –BCS theory (qualitative) –high temperature superconductors –Josephson effects applications.

UNIT 4 Semiconductor Physics 8 Hours

Introduction, origin of energy band, intrinsic and extrinsic semiconductors, mechanism of conduction in intrinsic semiconductors, generation and recombination, carrier concentration in intrinsic semiconductors, variation of intrinsic carrier concentration with temperature, n-type and p-type semiconductors, carrier concentration in n-type and p- type semiconductors, Drift and diffusion currents in semiconductors.

UNIT 5 Semiconductor Devices 8 Hours

Zener Diode, Tunnel diode, Hall effect and its applications, magnetoresistance, p-n junction layer formation and V-I characteristics, direct and indirect band gap semiconductors, construction and working of photodiode, LED, solar cell.

PHYSICS LABORATORY

List of Experiments

1. To determine the magnetic field along the axis of a circular coil carrying current.
2. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
3. To determine magnetic susceptibility by Quincke's tube method
4. To determine the Hall coefficient using Hall effect experiment
5. To determine the resistivity of semiconductor by Four probe method
6. To determine the energy gap of a semiconductor.
7. To study the characteristics of PN Junction diode.
8. To study magnetic hysteresis loop (B-H curve).
9. To determine the dielectric constant of a substance by resonance method.
10. To determine hysteresis loss by CRO.
11. To study the characteristics of Photodiode
12. To study the characteristics of Solar Cell
13. To study the characteristics of Zener diode
14. To study the resonance of LCR circuit

Text Books:

1. David J.Griffiths, "Introduction to Electrodynamics", 4/e, Pearson Education, 2014.
2. Charles Kittel, "Introduction to Solid State Physics", Wiley Publications, 2011.
3. M. N. Avadhanulu, P.G. Kshirsagar, "A Text book of Engineering Physics", 11/e, S. Chand Publications, 2019.

References:

1. Principles of Physics, 10ed, ISV, Jearl Walker, David Halliday, Robert Resnick, Wiley India.
2. Gerd Keiser, "Optical Fiber Communications", 4/e, Tata Mc Graw Hill, 2008.
3. S.O.Pillai, "Solid StatePhysics", 8/e, New Age International, 2018.

4. S.M. Sze, “Semiconductor Devices-Physics and Technology” , Wiley, 2008.

Journal(s):

1. https://aapt.scitation.org/doi/abs/10.1119/1.3317450
2. https://aapt.scitation.org/doi/full/10.1119/1.5144798
3. https://aapt.scitation.org/doi/abs/10.1119/1.1511591

Course Outcomes:

1. Apply mathematical principles to estimate magnetic and electric forces, fields and waves
2. Use the principles of EM waves and Maxwell equations to understand communication systems
3. Apply basic properties of dielectric, magnetic and superconducting materials in electromagnetics
4. Understand physics of semiconducting materials
5. Use working principles of semiconducting devices in electronic circuits

Text Book:

1. S. Balasubramanian, M.N. Srinivasan “A Text book of Practical Physics”- S Chand Publishers,2017

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1							1			1	1		
CO2	1	1							1			1	1		
CO3	1	1							1			1	1		
CO4	1	1							1			1	1		
CO5	1	1							1			1	1		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

PHYS1011	MECHANICS AND PROPERTIES OF MATTER	L	T	P	S	J	C
		3	1	0	0	0	4
Pre-requisite	**NIL**						
Co- requisite	**NIL**						
Preferable exposure	**NIL**						

Course Description:

This course is designed for students of Aerospace, Civil and Mechanical Engineering. It introduces fundamentals of elasticity and thermal properties – the essentials for understanding the behaviour of materials. Mechanics of solids is taught to acquaint them with the behaviour of rigid objects. An introduction to sensors will be useful for all the branches as an application of modern technology.

Course Educational Objectives:

1. To acquaint the basic concepts of sound waves and principles in acoustic design.
2. To introduce the concepts of elasticity, strain hardening and failure in materials and impart the relation between stress and strain.
3. To impart the phenomenon of heat transfer so as to understand a wide variety of practical engineering problems.
4. To demonstrate the use of Newton's laws of motion for understanding the mechanics of a particle.
5. To explain the working principle and construction of different types of sensors.

UNIT 1 Mechanics 10 Hours

Basic laws of vectors and scalars; Rotational frames; Conservative and non-conservative forces; F = - grad V; Central forces; Elliptical, parabolic and hyperbolic orbits; Noninertial frames of reference; Centripetal acceleration; Harmonic oscillator; Damped harmonic motion; Forced oscillations and resonance. Degrees of freedom.

UNIT 2 Elasticity 8 Hours

Concepts of elasticity and plasticity, stress and strain, Hooke's law, different moduli of elasticity, Poisson's ratio, strain energy, stress-strain diagram, elastic behavior of a material, factors affecting elasticity, relation between different moduli of elasticity, determination of elastic moduli.

UNIT 3 Thermal Properties 10 Hours

Transfer of heat energy; Thermal expansion of solids and liquids; Expansion joints - bimetallic strips; Thermal conduction, convection and radiation and their fundamental laws; Heat conductions in solids; Thermal conductivity - Forbe's and Lee's disc method: theory and experiment; Applications (qualitative only): heat exchangers, refrigerators, ovens and solar water heaters.

UNIT 4 **Acoustics** **8 Hours**

Characteristics of sound waves; Weber-Fechner Law; Absorption coefficient, determination of absorption coefficient; Reverberation time; Sabine's formula, derivation of Sabine's formula using growth and decay method; Intensity of sound; Acoustics of buildings, Acoustic requirements of a good auditorium.

UNIT 5 **Sensors** **9 Hours**

Sensors (qualitative description only); Different types of sensors and applications; Strain and pressure sensors- Piezoelectric, magnetostrictive sensors; Fibre optic methods of pressure sensing; Temperature sensor - bimetallic strip, pyroelectric detectors; Hall-effect sensor; Smoke and fire detectors.

Text Books:

1. D.Kleppner and Robert Kolenkow"An Introduction to Mechanics- II" Cambridge University Press,2015.
2. M.N. Avadhanulu & T.V.S. Arun Murthy, S Chand A Textbook of Engineering Physics, Volume-I 2018.
3. Ian R Sinclair, Sensor and Transducers 3/e,Elsevier (Newnes), 2001.

References:

1. M K Varma, "Introduction to Mechanics"-Universities Press, 2015
2. Prithwiraj Purkait, Budhaditya Biswas and Chiranjib Koley, Chapter 11 Sensors and Transducers, Electrical and Electronics Measurements and Instrumentation, 1/e., McGraw Hill Education (India) Private Limited, 2013.

Course Outcomes:

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

1. describe the fundamental principles of acoustics with emphasis on physical mechanisms, law and relationships
2. apply the concepts of strain, internal force, stress and equilibrium to deformation of solids
3. explain the fundamental theory for the analysis of heat transfer processess in solids and liquids and to apply basic principles of heat transfer in design of refrigerators and heaters
4. estimate forces and moments in mechanical systems using scalar and vector techniques
5. outline the basic principle and operation of different types of sensors

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1							1			1		1	1	
CO2	1	1						1			1		1	1	
CO3	1	1						1			1		1	1	
CO4	1	1						1			1		1	1	
CO5	1					1		1			1		1	1	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

PHYS1021	PRINCIPLES OF QUANTUM MECHANICS	L	T	P	S	J	C
		3	1	0	0	0	4
Pre-requisite	**NIL**						
Co- requisite	**NIL**						
Preferable exposure	**NIL**						

Course Description:

This course is designed with principles of Quantum mechanics for advanced courses in their respective engineering branches. It introduces Quantum mechanics with relevant mathematical tools and provides a basis for further study of quantum mechanics. It also introduces basics of Qubits for Quantum computing applications.

Course Educational Objectives:

1. To introduce the basic principles of quantum mechanics.
2. To introduce wave equation and significance of wave function.
3. To teach solving the Schrödinger's equation for spinless particles moving in one-dimensional potential.
4. To develop an understanding of concepts of angular momentum.
5. To introduce Dirac bra-ket formalism and the concept of QUBITs.

UNIT 1 Introduction to Quantum Physics 10 Hours

Introduction, Classical Mechanics vs Quantum Mechanics, Planck's quantum theory (qualitative), Photo-electric effect. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them, Wave-particle duality, Heisenberg uncertainty principle: ground state energy of hydrogen atom.

UNIT 2 Properties of Matter Waves 8 Hours

Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities, and normalization.

UNIT 3 Quantum Tunneling 8 Hours

One dimensional infinitely rigid box-energy eigenvalues and eigenfunctions, normalization; Quantum dot as example; Quantum mechanical tunnelling in one dimensional rectangular potential barrier, 1D linear harmonic oscillator (no derivation required, only eigen function, eigen values and zero-point energy).

UNIT 4 Quantum Properties of Electrons 9 Hours

Electron angular momentum, angular momentum operator, Space quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect, Stark Effect, Gyromagnetic Ratio and Bohr

Magneton (qualitative)

UNIT 5 Qubits for Quantum Computing 10 Hours

Introduction to Dirac Bra-Ket notation, Introduction to Pauli spin matrices, Quantum Superposition, Interference, Quantum Measurement, Decoherence, Entanglement, Bloch sphere, Qubits, and multiple qubits, Qubits Vs classical bits, representation of a qubit probability.

Textbooks:

1. Quantum Mechanics, G. Aruldhas, 2ndEdn. 2002, PHI Learning of India.
2. Quantum Mechanics, Satya Prakash, 2016, Pragati Prakashan.
3. Quantum Computing for Everyone, Chris Bernhardt, 2019, The MIT Press,

References:

1. Introduction to Quantum Mechanics, D.J. Griffith, 2ndEd. 2005, Pearson Education.
2. Quantum Computing: An Applied Approach, Jack D. Hidary, 2019,

Journal(s):

1. https://aapt.scitation.org/doi/full/10.1119/1.4897588
2. https://aapt.scitation.org/doi/full/10.1119/1.3639154

Websites

1. https://www.intechopen.com/online-first/73811
2. https://www.quantum-inspire.com/kbase/what-is-a-qubit/

Course Outcomes:

At the end of this course, the students will be able to:

1. Explain the basic principles of quantum mechanics.
2. Interpret wave equation and significance of wave function.
3. Solve the Schrödinger's equation for spinless particles moving in one-dimensional potential.
4. Understand of concepts of angular momentum and spin.
5. Apply Dirac bra-ket formalism to the concept of QUBITs.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1							1			2	1		
CO2	1	1							1			2	1		
CO3	1	1							1			2	1		
CO4	1	1							1			2	1		
CO5	2	2							2			2	2	1	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

<table>
<tr><td rowspan="2">PHYS1241</td><td rowspan="2">PHYSICS OF OPTOELECTRONIC DEVICES</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Co- requisite</td><td colspan="7">NIL</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">NIL</td></tr>
</table>

Course Description:

This course is designed with fundamentals of electromagnetism and properties of materials for advanced courses in their respective engineering branches. It introduces electromagnetic theory with relevant mathematical tools, optical fibres and their propagation characteristics, properties of dielectric and magnetic materials. It also introduces principles of semiconductors, and some widely used semiconductor devices for various applications.

Course Educational Objectives:

1. To introduce nature light and its properties.
2. To familiarize students with different semiconductors and its energy band gaps.
3. To introduce semiconductor physics and devices.
4. To impart knowledge about the semiconducting optical devices.
5. To demonstrate the properties of different semiconducting optical devices.

UNIT 1 Elements of light 8 Hours

Nature of light, Light sources, Black body, Colour temperature, Units of light, Radio metric and photometric units, Light propagation in media and waveguides, Electro-optic effects. Overview of luminescence: Photoluminescence, Cathodoluminescence, Electroluminescence, Injection-luminescence.

UNIT 2 Semiconductor Materials 10 Hours

Free electron theory of metals, Density of states in 1D, 2D, and 3D, Bloch's theorem for particles in a periodic potential, Energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Occupation probability, Fermi level, Effective mass.

UNIT 3 Principles of Lasers 10 Hours

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Einstein coefficients, Population inversion, Transition rates (Fermi's golden rule), Optical loss and gain; semiconducting diode laser, applications of semiconductor Lasers.

UNIT 4 Solar cells and Photovoltaic devices 9 Hours

Charge carrier generation and recombination, p-n junction model and depletion capacitance, Photovoltaic effect, Physics of Solar Cells, Principle of solar energy conversion,

Conversion efficiency, Type of solar cells in use: Dye Sensitized Solar Cells, Thin film solar cells, Perovskite Solar cell.

UNIT 5 Semiconductor devices 8 Hours

Radiative recombination devices: Light-emitting diodes (LED), Organic Light Emitting Diodes (OLED) and its types, Photoelectric devices: Photodiodes. Photo conducting devices: Photodetectors and photoconductors, Photoresistors, Photo transistors.

Textbooks:

1. Jasprit Singh, Optoelectronics – An Introduction to materials and devices; McGraw Hill,1996.
2. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition 2019
3. Maurice Quillec, Materials for Optoelectronics; Springer Science, 1996.
4. S. C. Gupta, Optoelectronic Devices and Systems; Prentice Hall India, 2005.
5. P. Bhattacharya, Semiconductor optoelectronic devices; Prentice Hall India, 2006.

References:

1. Pyshkin, Ballato, Optoelectronics - Advanced Materials and Devices; InTech, 2013.
2. Manijeh Razeghi, Optoelectronic materials and device concepts; SPIE, 1991
3. Sun and Dalton, Introduction to Organic Electronic and Optoelectronic Materials and Devices; CRC Press, 2008.
4. J. Palais, Introduction to optical electronics; Prentice Hall, 1988.
5. Jasprit Singh, Semiconductor optoelectronics; McGraw-Hill, 1995.

Course Outcomes:

After completion of this unit, the student will be able to

1. Outline the properties of semiconductors
2. explain the occupation probability and Fermi level variation in different electronic materials
3. Know about the interaction of light with materials and its optical properties
4. Explain the conduction mechanism in semiconducting and optical devices.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1							1			1	1		
CO2	2	1							1			2	1		
CO3	1	1							1			2	1		
CO4	2	1					1		1			2	1		1
CO5	2	1					1		1			2	1		1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

PHYS1041	MECHANICS AND MODERN PHYSICS	L	T	P	S	J	C
		3	1	0	0	0	4
Pre-requisite	NIL						
Co- requisite	NIL						
Preferable exposure	NIL						

Course Description:

This course designed for students of Biotechnology to impart principles of Newtonian mechanics will help the students in understanding the oscillatory behavior of materials. It also introduces fundamentals of quantum mechanics – the essentials for understanding the behavior of properties of materials. Fundamentals of optics and electromagnetism in understanding the use in spectroscopy. An introduction to sensors will be useful for all the branches as an application of modern technology.

Course Educational Objectives:

1. To impart knowledge on damped and forced oscillations.
2. To familiarize students with the concepts of quantum mechanics
3. To impart knowledge concerning the wave properties of electromagnetic waves
4. To familiarize the students about the Maxwell's equations and its propagation
5. To outline the principles and working of few common sensing devices

UNIT 1 Fundamentals of Dynamics and Oscillations 10 Hours

Fundamentals of Dynamics: Reference frames. Inertial frames; Galilean transformations.
Galilean invariance. Review of Newton's Laws of Motion.
Oscillations: SHM, Simple Harmonic Oscillations. Differential equation of SHM and its solution. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor

UNIT 2 Modern Physics (Quantum Physics) 8 Hours

Introduction, matter waves and its properties, Davisson-Germer experiment, GP Thomson experiment, Heisenberg's uncertainty principle, Schrodinger's time independent wave equation, physical significance of wave function, particle in a one-dimensional infinite well, rectangular potential barrier (transmission coefficient), band theory of solids (qualitative), distinction between metals, insulators and semiconductors, introduction to Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstien statistics.

UNIT 3 Optics 10 Hours

Interference: Introduction, interference in thin films due to reflected light: interference in parallel-sided film and wedge-shaped film, Newton's rings. Diffraction: Introduction; Fraunhofer diffraction at single slit (qualitative only), diffraction due to N-slits (diffraction

grating) (qualitative only), determination of wavelength of light with a plane transmission grating.
Polarisation: Introduction; Double refraction –double refraction in calcite crystal, negative and positive crystals, Nicol's prism, Retarders (quarter and half¬wave plates).

UNIT 4 Maxwell`s equations and Electromagnetic wave propagation 8 Hours
Maxwell's equations (both differential and integral forms) and its physical significance, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization of EM waves.

UNIT 5 Sensors 9 Hours
Sensors (qualitative description only); Different types of sensors and applications; Strain and pressure sensors -Piezoelectric, magnetostrictive sensors, ultrasonic sensors; Fibre optic methods of pressure sensing; Temperature sensor -bimetallic strip, pyroelectric detectors; Hall-effect sensor; Smoke and fire detectors

Textbooks:

1. Mechanics, D.S. Mathur, S.Chand and Company Limited, 2000.
2. A Text Book of Optics, 25/e, Brij Lal, M N Avadhanulu & N Subrahmanyam, 2012, S. Chand Publishing.
3. Ian R Sinclair, Sensor and Transducers 3rd eds, 2001, Elsevier (Newnes)
4. David J. Griffiths, "Introduction to Electrodynamics"-4/e, Pearson Education,2014
5. M.N. Avadhanulu, P.G. Kshirsagar, A Textbook of Engineering Physics, S.Chand, 2014.

References:

1. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
2. Prithwiraj Purkait, Budhaditya Biswas and Chiranjib Koley, Chapter 11 Sensors and Transducers, Electrical and Electronics Measurements and Instrumentation, 1st eds., 2013 McGraw Hill Education (India) Private Limited.
3. Elements of Properties of Matter, D. S. Mathur, S. Chand Publishing

Journal(s):

1. https://aapt.scitation.org/doi/abs/10.1119/1.3317450
2. https://aapt.scitation.org/doi/full/10.1119/1.3639154

Course Outcomes:

At the end of this course, the students will be able to:

1. Understand the concept of damped and forced oscillations.
2. Understand concepts of quantum mechanics
3. Understand interference, diffraction and polarization of light waves
4. Know about the maxwell's equations and its propagation
5. Use principles and working of few common sensing devices

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						1				1	1				
CO2						1				1	1				
CO3						1				1	1				
CO4						1				1	1				
CO5						1				1	1				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

PROJ2999	CAPSTONE PROJECT – INTRODUCTION	L	T	P	S	J	C
		0	0	0	0	2	2
Pre-requisite	NIL						
Co- requisite	NIL						
Preferable exposure	NIL						

Course Educational Objectives:

1. 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.

Course Logistics

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.

1. Project can be for one or two semesters based on the completion of required number of credits as per the academic regulations.
2. Can be individual work or a group project, with a maximum of 3 students.
3. In case of group projects, the individual project report of each student should specify the individual’s contribution to the group project.
4. Carried out inside or outside the university, in any relevant industry or research institution.
5. Publications in the peer reviewed journals / International Conferences will be an added advantage

Mode of Evaluation: Periodic reviews, Presentation, Final oral viva, Poster submission

Course Outcomes:

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. Synthesis the results and arrive at scientific conclusions / products / solution

6. Document the results in the form of technical report / presentation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

PROJ3999	CAPSTONE PROJECT – FINAL	L	T	P	S	J	C
		0	0	0	0	6	6
Pre-requisite	PROJ2999						
Co- requisite							
Preferable exposure							

Course Educational Objectives:

1. 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.

Course Logistics:

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.

1. Project can be for one or two semesters based on the completion of required number of credits as per the academic regulations.
2. Can be individual work or a group project, with a maximum of 3 students.
3. In case of group projects, the individual project report of each student should specify the individual's contribution to the group project.
4. Carried out inside or outside the university, in any relevant industry or research institution.
5. Publications in the peer reviewed journals / International Conferences will be an added advantage

Mode of Evaluation: Periodic reviews, Presentation, Final oral viva, Poster submission

Course Outcomes:

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. Synthesis the results and arrive at scientific conclusions / products / solution
6. Document the results in the form of technical report / presentation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

PROJ2888	PROJECT EXHIBITION 1	L	T	P	S	J	C
		0	0	0	0	1	1
Pre-requisite							
Co- requisite							
Preferable exposure							

Course Educational Objectives:

To provide platform for the student to exhibit their project work to

1. Excite interested students in continuing/initiating in the work of interest
2. Attract startups/industry to commercialize the project work
3. acquire comments on improving the quality of the work from other students/academicians/industry

Mode of Evaluation: Poster submission, Viva-Voce Examination

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

PROJ3888	PROJECT EXHIBITION 2	L	T	P	S	J	C
		0	0	0	0	1	1
Pre-requisite	PROJ2888						
Co- requisite							
Preferable exposure							

Course Educational Objectives:

To provide platform for the student to exhibit their project work to

- Excite interested students in continuing/initiating in the work of interest
- Attract startups/industry to commercialize the project work
- acquire comments on improving the quality of the work from other students/academicians/industry

Mode of Evaluation: Poster submission, Viva-Voce Examination

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

<table>
<tr><td rowspan="2">VIVA3555</td><td rowspan="2">COMPREHENSIVE EXAMINATION</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">Completion of minimum of six semesters</td></tr>
<tr><td>Co- requisite</td><td colspan="7"></td></tr>
<tr><td>Preferable exposure</td><td colspan="7"></td></tr>
</table>

Course Educational Objectives:

1. Designed to test the students on the Aerospace Engineering concepts, and tools, and the process of identifying and solving engineering problems.

UNIT 1 Engineering Mechanics

Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.; trusses and frames; virtual work; kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Lagrange’s equation.

UNIT 2 Mechanics of Materials

Stress and strain, elastic constants, Poisson's ratio; Mohr’s circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; concept of shear centre; deflection of beams; torsion of circular shafts; Euler’s theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength

UNIT 3 Thermodynamics

Thermodynamic systems and processes; properties of pure substances, behaviour of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations

UNIT 4 Fluid Mechanics

Fluid properties; fluid statics, forces on submerged bodies, stability of floating bodies; control volume analysis of mass, momentum, and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli’s equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings; basics of compressible fluid flow.

UNIT 5 Machining and Machine Tool Operations

Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming

Mode of Evaluation: 12 Quizzes with Multiple Choice Questions. Best 10 quizzes are considered for computing 100M. Student shall score atleast 80% in atleast 8 quizzes to be considered for grading

Course Outcomes:

The students will be able to

1. Apply knowledge of mathematics, science, and engineering
2. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health care and safety, manufacturability, and sustainability

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

BTEN1001	INTRODUCTION TO BIOTECHNOLOGY-I	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	Nil						
Co- requisite	Nil						
Preferable exposure	Nil						

Course Description:

This course introduces the student to the basics of biology such as classification, cell structure, biomolecular structure, metabolism, function

Course Educational Objectives:

- Introduce the cellular basis of life.
- Provide the basis for classification of living organisms.
- Describe the important biomolecules
- Describe the applications of biomaterials
- Describe the different metabolic pathways

UNIT 1 **6 hours**

Introduction to Biology, Cellular basis of life, differences between prokaryotes and eukaryotes. Classification based on carbon and energy sources, Tools of molecular taxonomy

UNIT 2 **8 hours**

Biomolecules, structure and functions of proteins, nucleic acids, lipids and sugars. Structure and function of hemoglobin, antibodies and enzymes. Industrial applications of enzymes

UNIT 3 **10 hours**

Bioenergetics, Respiration: Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation. Anaerobic respiration and Fermentation and its industrial applications Mechanism of photosynthesis, Light and dark reactions

UNIT 4 **12 hours**

Genetics: Mendel's laws of inheritance. Gene interactions- Epistasis, Incomplete & Codominance, Multiple alleles, Additive, complementation, Pleiotropism. Linkage, Crossing over. Gene mapping. Cell cycle and regulation. Mitosis and Meiosis

UNIT 5 **14 hours**

Human physiology – Membrane transport- Active and passive. Cell signaling and communication. Neurons – structure, function and types. Synapse-types, neurotransmitters, transmission of nerve impulse. Neuromuscular junctions. Muscle- structure, function and types.

Textbooks:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
2. Arthur T Johnson, Biology for Engineers, CRC press, 2011

References

1. Alberts et. al. The molecular biology of the cell, 6/e, Garland Science, 2014
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009.
3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e, 2012.

Course Outcomes:

After the completion of the course the student should be able to

1. Explain classification of living organisms.
2. Explain cell as the basis of life
3. Explain the importance of various biomolecules
4. Summarize application of enzymes and fermentation in industry.
5. Analyze metabolic pathways

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1										2			3			
CO2											2		3			
CO3		2	2							1			2			
CO4	3									3				3		
CO5		3				1				3	1	1			3	

APPROVED IN:

BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

BTEN1021	INTRODUCTION TO BIOTECHNOLOGY-II	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	Nil						
Co- requisite	Nil						
Preferable exposure	Nil						

Course Description:

This course introduces the student to the Applications of Biotechnology in plant , animal and industrial development

Course Educational Objectives:

1. Describe the concept of Central Dogma of Molecular Biology
2. Describe the transfer of genetic information.
3. Introduce recombinant DNA technology
4. Introduce the techniques used for modification of living organisms

UNIT 1 10 hours

Biotechnology: Concept, scope and importance. Origin of life-theories. Structure of bacterial, plant and animal cells-functions of cell organelles. Significance of biomolecules in biological systems

UNIT 2 12 hours

The central dogma of molecular biology. Concepts of genetic engineering, Restriction endonucleases, cloning vectors, methods of gene transfer. Polymerase Chain Reaction. Introduction to bioinformatics and biological databases

UNIT 3 12 hours

Biotechnology for Plant improvement: Strategies for engineering stress tolerance, transgenic plants. Micropropagation of novel varieties. Production of secondary metabolites and their importance. Molecular pharming.

UNIT 4 12 hours

Biotechnology for improvement of animals: Applications in animal husbandry, medicine and animal husbandry. Transgenic animals. Gene therapy and genetic counselling. Bioethics.

UNIT 5 14 hours

Industrial and Microbial Biotechnology: Overview of industrial fermentation process and products. Fermentation technology for production of Penicillin. Introduction to patents. Biotech industry in India and abroad.

Textbooks:

1. J.M. Walker and R. Rapley, Molecular Biology and Biotechnology, 5/e, Royal society of chemistry, 2009.
2. W. Godbey, An Introduction to Biotechnology, The Science, Technology nd Medical Applications, 1/e, Woodhead Publishing, 2014.

References

1. P.K. Gupta, Elements of Biotechnology, 2/e, Rastogi Publications, 2014.
2. B. Albert’s, A. Johnson, J. Lewis, D. Morgan, M. Raff, K. Roberts and P.Walter, Molecular Biology of the Cell, 6/e, Garland Publishers, 2014.
3. H. Lodish, A. Berk, C. A. Kaiser, M. Krieger, A. Bretscher, H. Ploegh, Amon and M. P. Scott, Molecular Cell biology, 7/e, W.H Freeman and Company, 2014.

Course Outcomes:

After the completion of the course the student should be able to

1. Explain the scope and importance of biotechnology
2. Understand the application of biotechnology in transgenic plant development.
3. Understand the role of biotechnogy in animal husbandry and livestock improvement
4. Explain the potential of biotechnology in industry in strain improvement

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1									2			3			
CO2		2									2		3			
CO3			3							1			2			
CO4	3									3				3		
CO5		3				1				3	1	1			3	

APPROVED IN:

BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

<table>
<tr><td rowspan="2">FINA1031</td><td rowspan="2">PRINCIPLES AND PRACTICE OF BANKING</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">Nil</td></tr>
<tr><td>Co- requisite</td><td colspan="7">Nil</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">Nil</td></tr>
</table>

Course Description:

The significance of the banking sector in India has been continuously upward for several decades. The sector is playing a role of a catalyst in the development of the economy. The Banks started playing a critical role in the social development process and became a partner in Government's welfare schemes and policies. Principles of and Practices of Banking course explores the fundamental principles and practices of banking and credit in India. It helps students to understand basics of banking and regulation to recent developments in Banking technology

Course Educational Objectives:

1. To understand the Indian financial system, role of commercial Banks, RBI in India and the regulations of Indian Banks.
2. To comprehend the banking Principles
3. To give the student adequate exposure to banking practice.
4. To acquaint and apply innovations in the banking sector.
5. To give an overall exposure to banking Principles and Practice.

UNIT 1 Banking System and Structure 9 Hours

Banking system and structure in India: Evolution of Indian Banks-Types of banks; Commercial Banks, Cooperative Banks, Role of RBI; Banking Regulation, Constitution, Objectives, Functions of RBI, Tools of Monetary control; Regulatory Restrictions on Lending. Types of Banking- Retail, Wholesale and International Banking.

UNIT 2 Risk management and Basel Accords 9 Hours

Introduction to Risk Management and Basel I, II &III Accords. Role and functions of CIBIL. Fair practices code for debt collection. Principles of Lending: Cardinal Principles, Non-fund-based limits, Credit appraisal Techniques. Cash management services and its importance.

UNIT 3 Functional Banks 9 Hours

Banker Customer Relationship: Types, Different Deposit Products & Services, Services to customers and Investors; PMLA Act; KYC Norms; Banker as lender: Types of loans, Overdraft facilities, Discounting of bills, Financing book Debts and supply bills- Charging of Security bills- pledge, mortgage

UNIT 4 Customer Protection 9 Hours

COPRA Act and its operational aspects; Banking Ombudsman Scheme; Role and duties Paying and collecting Banks; Banker Protection under Negotiable Instrument Act- Endorsement, Forged Instruments- Bouncing of Cheques and their implications; Operational aspects of opening and maintaining accounts of various types of account holders. Ancillary Services: Remittances & Safe Deposit lockers, Govt Business, EBT

UNIT 5 Banking Technology 9 Hours

Computer Systems: LAN,WAN, UPS, Core banking, Data warehousing, Data Mining. Digital Banking: ATMs, Electronic Kiosks-CDK, BNA, PBP; Cards – Types, Networks, Wallets; PPI. Electronic Banking – Internet & Mobile Banking. Trends In Communication Networks for Banking: EFT System, SWIFT, RTGS, NEFT, Automated Clearing System. Digital Payment Systems – NPCI

Textbooks:

1. Principles and Practices of Banking, IIFB, 5thEditionn 2021
2. Principles And Practices Of Banking (Paperback, N S TOOR & ARUNDEEP TOOR) 14th Edition

References:

1. Shekhar&Shekhar (2010),Banking Theory and Practice, New Delhi: Vikas Publishing House.
2. P.K. Srivastav(2011),Banking Theory and Practice, NewDelhi:Vikas Publishing House.
3. Sundaram& P.N. Varshney (2010), Banking Theory, Law and Practice, New Delhi:S.Chand& Co.
4. Padmalatha Suresh and Justin Paul (2013),Management of Banking and Financial Services, New Delhi: Pearson Education.

Journal(s):

1. GITAM Journal of Management, Visakhapatnam.
2. The Journal of Banking Studies, Mumbai.

Website(s):

1. https://www.icai.org/

Course Outcomes:

1. Student acquires knowledge about theoretical aspects of banking and
2. Student acquires knowledge about relationship between banker and customer
3. Student learns about the practicalities of banking and the latest trends in banking.
4. Students develops skills about legal aspects and negotiable instruments.
5. Student enhance knowledge about latest banking trends and technology.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	0	0	0	0	0							3	1	0
CO2	1	2	0	1	0	0							2	1	1
CO3	2	2	3	2	1	0							0	1	1
CO4	1	2	3	2	1	2							2	0	1
CO5	0	0	0	0	1	1									

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

HRMG1021	HUMAN RESOURCE MANAGEMENT	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	Nil						
Co- requisite	Nil						
Preferable exposure	Nil						

Course Description:

Success in today's competitive business environment is increasingly a function of effective management of its resources, particularly human resources, which are the most valuable assets of an organization. The efficiency and quality of service of an organization depend on its employee's enthusiasm and satisfaction with their jobs, which are directly related to their sense of being treated fairly. To become a successful manager, it is imperative to understand human sensitivities and factors that motivate individuals. Human Resource Management course provides the basic tools required as an HR professional in an organization

Course Educational Objectives:

1. To Understand the fundamentals, evolution, function & challenges of HRM
2. To Explore the role of HRM in procurement, development of human resources
3. To Analyze the basic factors in designing the compensation and collective bargaining
4. To Evaluate safety and health and establish effective separation practices.

UNIT 1 Introduction 10 Hours

Introduction: Nature, scope and significance of HRM - Evolution of HRM – Recent trends in HRM – Functions of HRM – Challenges of HR managers.)

UNIT 2 Procurement 10 Hours

Procurement: Human Resource Planning – HR Forecasting methods - Job analysis and Job design – Recruitment - Selection – Induction.

UNIT 3 Development 10 Hours

Development: Identification of training needs - designing the training program – Methods of training – Difference between Training & Development.

UNIT 4 Compensation and Integration 10 Hours

Compensation and Integration: Introduction - Basic factors in determining pay rates – Basic, Supplementary and Executive Remuneration – types of employee benefits and services - Quality of work-life – Collective Bargaining.

UNIT 5 Separation and maintaining 10 Hours

Separation and Maintaining: Communication and Counseling - Safety and Health – Internal mobility - Retirement and Retirement benefits..

Textbooks:

1. Gary Dessler & Biju Varkkey, "Human Resource Management," Pearson, New Delhi, 16th edition.
2. George W Bohlander, Scott A Snell, "Principles of Human Resource Management," Cengage Learning, 2017.16th edition.
3. Aswathappa, K., Human Resource and Personnel Management: Text & Cases, TMGH
4. Subba Rao, P., Personnel and Human Resource Management (Text & Cases), Himalaya

References:

1. Edwin B Flippo, "Personnel Management," Tata McGraw Hill Publishing, New Delhi, 1984
2. John H. Bernardin, "Human Resource Management - An Experiential Approach," Tata McGraw Hill, New Delhi, 2013
3. Mirza, Saiyadain, "Human Resource Management," Tata McGraw Hill, New Delhi, 2013
4. Gary Dessler & Biju Varkkey, "Human Resource Management," Pearson, New Delhi, 2015 14th edition.

Journal(s):

- Harvard Business Review, Harvard Business School Publication USA
- People Matters Online Magazine
- Human Capital Magazine
- Vikalpa, Indian Institute of Management, Ahmedabad

Course Outcomes:

On successful completion of this course, students will be able to:

- Understanding the concept of HRM and its importance.
- Describe the process of workflow analysis and identify why it is essential to HRM.
- Understand the concepts of Training and Development
- List various factors determining pay rates.
- Analyze the role of the supervisor in employee safety and minimize accidents at the workplace.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2	1	0	2						3	1	0
CO2	1	2	1	3	1	1	1						2	1	1
CO3	2	1	2	2	1	0	1						0	1	1
CO4	2	1	2	1	1	1	3						2	0	1
CO5	0	0	2	3	0										

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 8 Decent Work and Economic Growth

SDG Justification: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

MKTG3011	SALES AND DISTRIBUTION MANAGEMENT	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	Nil						
Co- requisite	Nil						
Preferable exposure	Nil						

Course Description:

Sales Management focuses on the sales techniques and the management of the sales force. The success of any sales and marketing department lies in the effectiveness of the Sales Force. The goal of the Sales Management course is to examine the elements of an effective sales force as a key component of the organization's total marketing effort. A successful Sales Manager needs to understand the fundamentals of the sales process, the relationship between sales and marketing, sales force structure and issues in recruiting, selecting, training, motivating, compensating and retaining sales people.

Course Educational Objectives:

1. To understand the planning and staffing needs in professional sales
2. To learn how to manage and motivate a professional sales team as a Sales manager
3. To analyse the key success factors for sales executive performance.

UNIT 1

Introduction to Sales Management - Evolution of Sales Management, importance of Sales Management, types of Selling, difference between Selling and Marketing, Modern Day Sales Activities, Selling Skills, Selling Strategies, Selling Process.

UNIT 2

Sales Planning and Budgeting: Sales planning process, sales forecasting methods, sales budgeting process, methods used for deciding sales budget, types of quotas and quota setting procedure, reasons for establishing or revising sales territories, routing and scheduling sales persons, market cost analysis.

UNIT 3

Sales Force Management: Recruitment and selection of the sales force, training the sales force, sales force motivation, sales force compensation, sales force control and evaluation.

UNIT 4

Introduction to Distribution Management -Definition, need for Distribution Channels, designing the Marketing Channels, Motivating and Evaluating Channel Members, Capturing the Customer requirements

UNIT 5

Managing Distribution Channels - Managing Channel Information Systems, reasons for Channel Conflicts, Managing Conflict, Managing, Ethical issues in Sales and Distribution Management

Textbooks:

1. Krishna K Havaldar, Vasnt M Cavale, Sales and Distribution Management, 2nd edition, Tata Mcgraw Hill, 2011.

References:

1. Tapan K. Panda &Sunil Sahadev (2011), Sales and Distribution Management 2nd edition Oxford Press.
2. S.L. Gupta, M.K.Rampal (2009) Cases in Sales and Distribution Management, Himalaya Publication house.
3. K.Sridhara Bhat (2011) Sales and Distribution Management, 1st, Himalaya Publication house.
4. S.A.Chunawalla (2012) Sales and Distribution Management, 3rd edition, Himalaya Publication house.
5. Dinesh kumar (2012) Marketing Channels ,Oxford Press.
6. Richard R Still, Edward W Cundiff, Norman &A P Govoni(2011) Sales and Distribution Management, 5th edition, Pearson Publications.
7. Spiro Stanton & Rich (2010) Management of Sales Force, 13th edition, Tata McGraw Hill.
8. Prof. M.V. Kulkarni (2010) Sales and Distribution Management, Everest Publishing House.
9. Anne T Coughlan etal (2011), Marketing Channels, 7th edition, Pearson education.
10. Mark W Johnston, Greg W Marshall (2009), Sales Force Management, 9th edition, Tata McGraw Hill.
11. Dr.S.L.Guptha (2010), Sales and Distribution Management, 2nd edition, Excel books.
12. PingaliVenugopal (2012) Sales and Distribution Management, Sage Publications

Journal(s):

- Indian Journal of Marketing & Journal of Advertising Research
- GITAM Journal of Management, GITAM Institute of Management, GITAM Deemed to be university, Visakahapatnam
- Harvard Business Review, Harvard Business School Publication Co. USA
- Vikalpa, Indian Institute of Management, Ahmedabad

Course Outcomes:

On successful completion of this course, students will be able to:

1. Students would be able to understand the planning and staffing needs in professional sales.
2. Students would learn how to manage and motivate a professional sales team, as a sales manager.
3. Students would be able to analyze the key success factors for sales executive performance.
4. Students would learn how to manage and motivate distribution channel members.
5. Students can manage distribution channels and manage conflicts

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2	1	0	2	0	0	0	0	1	3	1	0
CO2	1	2	1	3	1	1	1	0	0	0	0	1	2	1	1
CO3	2	1	2	2	1	0	1	0	0	0	0	1	0	1	1
CO4	2	1	2	1	1	1	3	0	0	0	0	1	2	0	1
CO5	0	0	2	3	0	1	1	0	0	0	0	1	1	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 26-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

Programme Core

<table>
<tr><td rowspan="2">CIVL2001</td><td rowspan="2">ARCHITECTURAL PLANNING & CAD</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>1</td><td>0</td><td>2</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">None</td></tr>
<tr><td>Co-requisite</td><td colspan="7">None</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">AutoCAD</td></tr>
</table>

Course Description:

Drawing is the civil engineer's language. The student will be able to draw layout of site, plan, elevation and section with interior details. This course provides an overview of planning aspects of various buildings as per bye laws. This course is a prerequisite for Estimation and Costing.

Course Educational Objectives:

- To explain the basic commands used in detailing software.
- To introduce the fundamentals of computer aided drawing.
- To make them understand different types of building plans.
- To train to draw the plan, section, elevation and site plan.
- To familiarize with detailing code.

UNIT 1 Introduction to drawing 6 hours

Introduction to concept of drawings, Interpretation of typical drawings, Scales – Elements of a building drawing – Introduction to computer aided drawing, Drawing commands

UNIT 2 Sign conventions and symbols 6 hours

Layers and Annotations in AUTOCAD, Conventional Signs- Conventional signs – Materials, Architecture, Structure, Brick Bonds – Header, Stretcher, English and Flemish, one and half, two and two and half brick walls. Doors and Windows

UNIT 3 Building Planning 8 hours

Classification of buildings - principles of planning - dimensions of buildings. lighting and ventilation-space standards for residential, commercial & institutional categories, climatology and climatic considerations.

UNIT 4 Preparation of Building Plan 8 hours

Planning and preparing sketches and working drawings of Residential buildings. Plan, Section and Elevation from the given line drawing/Site plan/floor plan of residential and public buildings.

UNIT 5 Structural Detailing 6 hours

Drawing of structural members- Beam, column & slab cross sections. Introduction to SP 34. Detailing of staircase.

Drafting of following Using CAD software

1. Introduction of CAD and Practicing Commands
2. Drawing of conventional signs using CAD.
3. Foundation details of a building.
4. English bond and Flemish bond.
5. Drawing of stair case.
6. Drawing of cross section of door
7. Drawing of plan, section, elevation and site plan of residential single bed room building.
8. Drawing of plan, section, elevation and site plan of residential double bed room building.
9. Drawing of plan, section, elevation and site plan of duplex type house.
10. Preparation of plan, section, elevation and site plan of residential buildings with given specifications.
11. Reading of one Architectural Drawing set of Single/Multi-storied Building.

Detailing of structural members- Beam, column & slab cross sections

Text Books:

1. Subhash C Sharma and Gurucharan Singh, Civil Engineering Drawing, Standard Publishers, 2005.
2. N. Kumara Swamy, A. Kameswara Rao, Building Planning and Drawing

References

1. M.G. Shah, C.M. Kale and S.Y. Patki, Building Drawing with an Integrated Approach to Build Environment, Tata McGraw- Hill Publication, 2002.
2. Ajeet Singh, Working with AUTOCAD 2000 with updates on AUTOCAD 2001, Tata- Mc Graw-Hill Company Limited, 2002.
3. B.P. Verma, Civil Engineering Drawing and House Planning, Khanna Publishers, 2014.
4. V.M. Marimuthu, R. Murugesan, S. Padmini, S. Pratheeba, Civil Engineering Drawing-I, Publishers, 2008.
5. Venugopal, Engineering Drawing and Graphics + AUTOCAD, New Age International Pvt. Ltd.,2007.

Course Outcomes:

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

1. Demonstrating basic commands used in detailing software(L2).
2. Demonstrate and draw conventional signs, foundation details, cross section of a door and staircase (L2).
3. Draw different types of building plans(L1).
4. Construct plan, section and elevation of a residential building (L2).
5. Understand the importance of detailing code(L4).

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 0	PO 10	PO 11	PS1 2	PS O1	PS O2	PS O3
CO1	3	1	2	1	1	2	1	3	1	1	1	1	3	2	3
CO2	1	1	2	2	2	2	2	2	1	1	1	1	3	2	3
CO3	2	2	2	2	2	2	2	2	1	1	1	1	2	1	1
CO4	1	1	2	2	3	1	1	1	1	1	1	1	2	1	1
CO5	2	2	2	2	3	2	1	1	1	1	1	1	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

			L	T	P	S	J	C
CIVL2011	**PRINCIPLES OF MECHANICS**		**3**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	None							
Co-requisite	None							
Preferable exposure	None							

Course Description:

This course is an introduction to learning and applying the principles required to solve engineering mechanics problems. Concepts will be applied in this course from previous courses of basic mathematics and physics This course addresses the modelling and analysis of static equilibrium problems with an emphasis on real world engineering applications and problem solving. This course forms the backbone of Structural Engineering and acts as a prerequisite to mechanics of solids, structural analysis and fluid mechanics.

Course Educational Objectives:

- Explain the effect of force and moment and equilibrium in engineering applications.
- Explain the different types of frictions and their effects.
- Compute the forces in the various members of trusses.
- Compute geometric properties such as centroid and moment of inertia of various plane sections.
- Explain kinetics and kinematics of particles and rigid bodies.

UNIT 1 Introduction 8 hours

Introduction to Engineering Mechanics: Units, Significance of Engineering Mechanics, Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and non-concurrent, coplanar forces, resultant of coplanar force systems, couple, moment of a force, Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force systems.

UNIT 2 Friction 8 hours

Laws of friction, types of friction, equilibrium of force systems involving frictional forces, wedge friction. Free body diagrams involving frictional forces

UNIT 3 Analysis of Trusses 8 hours

Introduction to plane trusses, analysis of plane trusses by method of joints and method of sections.

UNIT 4 Geometrical Properties of Plane Sections and Moment of Inertia 8 hours

Geometrical Properties of Plane Sections: Centroid and center of gravity, Centre of Gravity of plane and composite sections.

Moment of Inertia: Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, radius of gyration.

UNIT 5 Kinematics and Kinetics 8 hours

Kinematics: Equations of motion for rigid bodies under constant and variable acceleration, rectilinear motion, projectile motion

Kinetics: Principles of dynamics - Newton's Laws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy.

Text Books:

1. N.H. Dubey, Engineering Mechanics: Statics and Dynamics, Tata McGraw Hill, 2014.
2. S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, Engineering Mechanics (in SI units), 5/e, McGraw Hill, 2013.

References:

1. Basudeb Bhattacharya, Engineering Mechanics, 2/e, Oxford University Press (India), 2015.
2. Irving Shames, G.K.M. Rao, Engineering Mechanics: Statics and Dynam-ics, 4/e, Pearson, 2009.
3. K.L. Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010.
4. S.S. Bhavikatti, Engineering Mechanics, 4/e, New Age International, 2008.

Course Outcomes:

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

1) obtain a basic understanding of the laws of solid mechanics. [L-1]
2) comprehend the significance of the concepts of solid mechanics in engineering systems. [L-2]
3) calculate the physical properties of rigid bodies required for the analysis of engineering systems. [L-3]
4) apply the principles of statics and dynamics to solve engineering problems. [L-3]
5) analyze various static and dynamic engineering systems and understand the underlying mechanics and drawbacks/problems. [L-4]

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3		3	1	2					2	2	2	2
CO2	2	3	3		3	1	2					2	2	2	2
CO3	2	3	3		3	1	2					2	2	2	2
CO4	2	3	3		3	1	2					2	2	2	2
CO5	2	3	3		3	1	2					2	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2021	FLUID MECHANICS	L	T	P	S	J	C
		3	0	2	0	0	4
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This basic course helps the learner to understand the behaviour of fluids, properties of fluids, measurement of pressure, velocity and discharge of flowing liquids. This course introduces the knowledge of principles of fluid statics, kinematics and fluid dynamics and to solve various problems related to hydrostatic forces on plane surfaces, hydrodynamic force on pipe bend. The learner will familiarize with the concepts to compute losses and discharge in pipe flow. This course introduces the fundamental knowledge of hydraulic machines like pumps and turbines.

Course Educational Objectives:

- to explain properties of fluids and pressure measurement using manometers.
- to describe the hydrostatic forces on different plane surfaces, classification of fluid flow, continuity equation, velocity potential, stream function, flow net analysis.
- to analyze fluid dynamics using Bernoulli's equation for measurement of flow using different flow measuring devices
- to impart concepts of flow through pipes for computation of losses and discharge in pipe flow.
- to teach the fundamentals of hydraulic machines like pumps and turbines.

UNIT 1 Properties of Fluids, Pressure Measurement 8 hours

Mass Density ,Specific Weight, Specific gravity, Specific Volume, Dynamic and Kinematic Viscosity, Surface Tension, Capillarity, Vapour Pressure, Bulk Modulus.

Fluid pressure, Pascal's law – Atmospheric, Gauge and Vacuum pressure – Measurement of pressure – Pressure gauges, Simple and Differential Manometers.

UNIT 2 Fluid Statics, Buoyancy and Fluid Kinematics 9 hours

Fluid Statics: Hydrostatic forces on submerged plane surfaces, center of pressure, buoyancy, metacentric height.

Fluid Kinematics: Types of fluid flow, Equation of continuity, stream function and velocity potential function, Flow-net.

UNIT 3 **Fluid Dynamics** **9 hours**

Types of forces – Bernoulli's equations for a 2-D flow and its application, Measurement of Flow using Venturi meter and Orifice meter, Momentum equation and its application – Forces on pipe bend.

UNIT 4 **Pipe Flow** **8 hours**

Reynolds experiment – Darcy-Weisbach's equation, total energy line and hydraulic gradient line, minor losses – pipes in series – pipes in parallel - Siphon pipe –Power transmission through pipes, water hammer.

UNIT 5 **Pumps and Turbines** **8 hours**

Pumps: (Theory only) Centrifugal Pumps – Single and Multistage Pumps – Working Principles – Priming.

Turbines: (Theory only) Classification of Turbines – Impulse Turbines - Reaction Turbines – Various components and their functions.

Fluid Mechanics & Hydraulic Machines Laboratory

List of Experiments

1. To determine the coefficient of discharge of Venturi meter and Orifice meter.
2. To determine the coefficient of discharge of mouthpiece and small orifice by constant head and falling head methods.
3. To determine the coefficient of discharge of V-notch (triangular notch) & rectangular notch.
4. To compute the friction factor using Darcy-Weisbach Equation for pipes of different diameters.
5. To verify the Bernoulli's equation.
6. To find the coefficient of impact of a jet impinged on to a fixed flat circular vane & hemispherical vane.
7. To study the performance characteristics of Pelton wheel turbine.
8. To study the performance characteristics of the Francis Turbine.
9. To study the working principles of a centrifugal pump.
10. To study the working principles of a reciprocating pump.

Text Books:

1. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics and Hydraulic Machines, Standard Book House, 2019.
2. A.K. Jain, Fluid Mechanics, Khanna publishers, 2010.

References:

1. L. Victor, Streeter and E. Benjamin Wylie, Fluid Mechanics, Tata McGraw Hill, 2015.
2. M. Franck White, Fluid Mechanics, Tata McGraw Hill, 2017.
3. K. Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill, 2001.
4. K.R. Arora, Laboratory Experiments in Fluid Mechanics, 2003.
5. Fluid Mechanics virtual labs. http://eerc03-iiith.vlabs.ac.in/
6. https://vspgitcivil.gitam.edu/Infrastructure

   Fluid Mechanics NPTEL Course:
   https://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/fluid_mechanics/index.htm
   https://nptel.ac.in/courses/105105110/

Course Outcomes:

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

1. Understand the principles of various properties of fluids (L-2), Compute pressure using manometers, forces on submerged bodies using hydrostatic law (L-3).
2. Determine the possibility of flow and its characteristics using continuity equation; velocity potential and stream function (L-3).
3. Compute discharge using Venturi meter, Orifice meter, orifice, mouthpiece, notches and weirs (L-3)
4. Apply Darcy-Weisbach equation to determine losses in pipes, power transmission through pipes (L-3).
5. Understand the working operation of Pumps and Turbines (L-2).

Laboratory Manuals

1. Laboratory Manuals available in FM Laboratory.
2. Sarbjit Singh, Experiments in Fluid Mechanics, Prentice Hall of India Pvt. Ltd, Learning Private Limited, Delhi, 2012.
3. V.P. Gupta J. Chadra and K.S. Gupta, Laboratory Manual of Fluid Mechanics and Machines, CBS Publishers and Distributors, New Delhi, 2006.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1				1	2	3	2		2	2		
CO2	3	2	1				1	2	3	2		2	2		
CO3	3	2	1				1	2	3	2		2	2		
CO4	3	2	1				1	2	3	2		2	2	2	1
CO5	3	2	2	2	2	2	1	3	3	3	1	2	2	2	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2031	SURVEYING	L	T	P	S	J	C
		3	0	2	0	0	4
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	**Measurements of lengths, areas etc**						

Course Description:

Surveying is the art of taking measurements which will determine the relative positions of various points on the surface of the earth. It may be represented on a plan to a convenient and suitable scale. The various natural and artificial features may be shown in their correct horizontal and vertical positions. The data collected from a survey is used in the preparation of plans, maps, profiles, charts and diagrams. In addition, process of surveying may be used for the delineation of property boundaries, computation of areas and volumes also to set out the proposed work on the ground.

Course Educational Objectives:

- impart knowledge on basics of surveying
- provide exposure to different techniques of surveying and associated equipment
- explain about tachometry, geodetic surveying, satellite surveying
- familiarize working principles of survey instruments and types of errors encountered in field and calculations
- demonstrate modern advanced surveying techniques involved such as remote sensing, total station, GPS, Photogrammetry etc

UNIT 1 Introduction, Chain and Compass Surveying 8 hours

Surveying objectives, plane surveying principles and classification, linear measurements, instruments for surveying, preparation of map and plan, measurement of distance, chain surveying principles, offsets, chain surveying instruments, measurement of directions and angles, problems on obstacles of chain surveying, types of compass, meridians and bearings, local attraction, magnetic declination, traversing with a chain and compass, plotting of traverse, adjustment of closing error, problems on chain surveying

UNIT 2 Plane table Surveying, Levelling and Contouring 8 hours

Principle and instruments used in plane table surveying, working operations, methods of plane table surveying, instruments for leveling, principle and classification of leveling, bench marks, readings and booking of levels, height (level) computations, field work, longitudinal and cross-sectional levelling, problems on levelling, plotting the profile, contours, characteristics of contours, contours of natural features, methods of contouring, interpolation, contour gradient, contour maps, problems on contouring.

UNIT 3 Theodolite Survey and Traversing, Tacheometric Surveying 9 hours

Theodolite component parts, classification, theodolite observations, principle of theodolite survey and traversing, field work, traverse computations, practical problems, principle of tacheometry, methods of tacheometry, tacheometric tables, reduction diagram, tacheometry as applied to subtense measurement, field work for tacheometric surveying, errors.

UNIT 4 Curve Setting 8 hours

Types of curves, elements of a curve, setting out a simple curve, setting out a compound curve, checks on field work, reverse curve, transition curves, super elevation, deflection angles, transition curves, characteristics of transition curves, types of vertical curves, setting out vertical curves, Construction Surveys: setting out of buildings, computation of areas, earthwork measurements: LS&CS, computation of volumes.

UNIT 5 Trigonometrical Surveying, Triangulation and Total Station 8 hours

Base of the object accessible, base of an inclined object accessible, reduced level of the elevated points with inaccessible bases, instrument axes at different levels, principle of triangulation, purpose and classification of triangulation surveys, layout of triangulation, field work, triangulation stations, triangulation computations, EDM instruments, total station, global positioning system

SURVEYING LABORATORY

List of Experiments:

1) Survey of an area by chain survey (closed traverse) and plotting
2) Compass traversing
3) Radiation method, intersection methods by plane table survey
4) Fly leveling (differential leveling)
5) Longitudinal and cross sectioning
6) Grid contouring and indirect contouring
7) Theodolite survey
8) Trigonometric leveling to determine heights/elevations
9) Tacheometry
10) Setting of curves
11) Demonstration of Auto level and
12) Demonstration of Total station and GPS

Text Books:

1. B.C. Punmia, A.K.Jain, Arun Jain, Surveying I and II, 17/e, Laxmi Publications, 2016.
2. R. Subramanian, Surveying and Levellin, 2/e, Oxford University Press, 2014.
3. D.G Charles, R.W. Paul, Elementary Surveying, 15/e, Prentice Hall, 2018

References:

1. S.K. Roy, Fundamentals of Surveying, 2/e, Prentice Hall of India, 2011.
2. T.P. Kanetkar, (2012), Surveying and Levelling, Part I and II, New Central Book Agency, 2012.

Course Outcomes:

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

1. Summarize about basics involved in different types of surveying like tape, compass, levelling, theodolite and tacheometer[L2]
2. demonstrate skills in measuring of distances, angles, levelling and curve setting[L2]
3. develop skill to carry out tachometry, geodetic surveying wherever situation demands.[L3]
4. select appropriate method of surveying based on the needs [L3]
5. inspect the accuracy of the recorded reading in surveying output [L4]

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3			2	3			3	3		2	3	2	
CO2	3	3		3	2	3			3	3		2	2	2	
CO3	3	3	1	3	2	3			3	3		2	3	3	
CO4	3	3		3		3		1	3	3			3	3	
CO5	3	3	1	3	2	3		1	3	3		2	3	2	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2041	MECHANICS OF SOLIDS	L	T	P	S	J	C
		3	0	2	0	0	4
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The response or deformation of elastic bodies subjected to different types of loading will be discussed. Various stresses developed such as bending, shear and torsion in structural elements will be estimated. The course is a prerequisite for Structural Analysis and design courses such as Design of RCC and Design of Steel structures.

Course Educational Objectives:

- To introduce the concepts of stress, strain, Hooke's law and their application.
- To demonstrate ethe concept of Shear Force (SF) and Bending Moment (BM).
- To explainthe concept of transformation of stresses and principal stresses.
- To facilitate the estimate of bending and shear stresses.
- To demonstrate the variation of shear stress in circular members under torsion

UNIT 1 **Simple Stresses and Elastic Constants** **8 hours**

Introduction, stress strain curve, factor of safety, lateral strain, bars of varying and tapering cross section, compound bars subjected to loads, temperature stresses in bars, Modulus of rigidity, complementary shear, Bulk Modulus, Relation between E and N.

UNIT 2 **Shear Forces and Bending Moments** **10 hours**

Beams, Types of loads and supports, Shear Force and Bending Moments, SF and BM diagrams for cantilever, simply supported and overhanging beams subjected to point loads and udl, Relationship between rate of loading, shear force and bending moment.

UNIT 3 **Complex stresses** 8 hours

Stresses on inclined plane on block subjected to normal stress and shear stress along two planes at right angles, principal plane and principal stresses, Mohr's circle for finding principal stresses, Directions of principal planes, Volumetric strain.

UNIT 4 **Stresses in beams** **8 hours**

Introduction, assumptions in the theory of bending, section Modulus, Shear Stresses in beams, Shear stress variation in rectangular sections.

UNIT 5 **Torsional Stresses in Shafts& Springs** **8 hours**

Torsional Stresses in Shafts& Springs:

Introduction, Analysis of Torsional Stresses, Power transmitted, Combined bending and Torsion, Principal Stresses.

Helical Springs: Closed coiled helical springs.

Mechanics of Solids Laboratory

LIST OF EXPERIMENTS:

1. Stress-strain characteristics of steel and cast iron by conducting tension test on rods.
2. Stress-strain characteristics of steel and cast iron by conducting compression test on rods.
3. Stress-Strain characteristics of steel and cast iron by conducting tension test on flats.
4. Shear strength of timber and steel by conducting

a) direct shear test for timber b) double shear test for steel

5. Hardness of steel, aluminum, copper and brass by conducting Brinell's, Rockwell's and Vickers's tests.
6. Impact strength of steel and aluminum by conducting Izod's and Charpy's tests.
7. Modulus of rigidity of steel wires and rods by conducting torsion test.
8. Compression strength of timber and brick by conducting compression test.
9. Failure planes of ductile and brittle materials under tension, bending and torsion.
10. Bending stress in cantilever beam by conducting bending test.
11. Shear stress in simply supported beam by conducting bending test.
12. Stiffness of helical spring under compression.

Text Books:

1. V.N Vazirani and M.M Ratwani, Analysis of Structures Vol-I, Khanna Publishers,2003.
2. R.Subrahmanian, Strength of Materials, 3/e, Oxford University Press, 2016.

References

1. **IS-1608:(2005)**- Metallic Materials - Tensile Testing at Ambient Temperature (Third Revision)

2. **IS432-Part I (1982)-**Specification for Mild Steel and Medium Tensile Steel Bars and Hard-Drawn SteelwireFor Concrete Reinforcement Part I Mild Steel and MediumTensile Steel Bars (Third Revision)

3. **IS 1500: (2005)**Method for Brinell Hardness Test For Metallic Materials(ThirdRevision)

4. **IS 1586 (Part 2) : 2012**Metallic Materials — Rockwell Hardness Test Part 2Verification and Calibration of Testing Machines (Scales A, B, C, D, E, F, G, H, K, N, T) (Fourth Revision)

5. **IS-1598 (2003)**Metallic Materials- Method for Izod Impact Test of Metals (First Revision)

6. **IS 1757:1988 (2003)**Method for Charpy Impact Test (V-Notch) on Metallic Material (Second Revision)

7. **IS 5242:1979 (2006)**Method of Test for Determining Shear Strength of Metals (First Revision)

8. sm-nitk.vlabs.ac.in.

9. https://home.iitm.ac.in/kramesh/Strength%20of%20Materials%20Laboratory%20Manual.pdf

10. Ferdinand.P.Beer&Russell.E.Johnston, Mechanics of Materials, Mc Graw Hill Education, 7/e, 2017.
11. S.S. Rattan, Strength of Materials, 2/e, Tata McGraw Hill Education,2011.
12. Gere &Timoshenko, Mechanics of Materials, 4/e, CBS Publishers& Distributors,2004.
13. Stephen Timoshenko, Strength of Materials Part I & II, 3/e, CBSPublishers& Distributors,2002.

Course Outcomes:

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

1. find the stresses, strains and deformationsin axially loaded members(L1).

2. Determine forces in statically determinate beams(L2).
3. identify the plane of principal stresses (L3).
4. interpret the flexural behavior and shear flow ofthe beams(L2).
5. find the stresses in circular shafts subjected totorsion(L1).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3							2		1		
CO2	2	2	3	3							2		2		
CO3	2	2	3	3							2			2	
CO4	2	2	3	3		3					2			2	
CO5	2	2	3	3		3					2		1		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

<table>
<tr><td rowspan="2">CIVL2051</td><td rowspan="2">ENVIRONMENTAL ENGINEERING</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>2</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">None</td></tr>
<tr><td>Co-requisite</td><td colspan="7">None</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">None</td></tr>
</table>

Course Description:

Water and waste water treatment removes contaminants and undesirable components, or reduces their concentration so that the water becomes fit for its desired end-use. To understand the mechanism of treatment process, this course involves the principles of science and engineering. This basic fundamental course introduces the student to estimate water demand and to calculate waste water generation. Study of physical, chemical and biological characteristics of water and waste water helps the student to assess the quality of water and degree of treatment to be given for their safe disposal.

Course Educational Objectives:

- to study the importance of Protected water supply and quality of water as per standards
- to impart the working principal of Sedimentation , filtration and disinfection methods
- to familiarize with various water distribution systems and its installations
- to expose sewage characteristic, treatment methods and design of unit operations
- to study the functionality of basic sanitary fitting in house plumbing.

UNIT 1 **8 hours**

Protected water supply – Population forecasts, design period – water demand – factors affecting – fluctuations – fire demand – water quality and testing – drinking water standards - Waterborne diseases - Comparison from quality and quantity and other considerations – intakes – infiltration galleries.

UNIT 2 **10 hours**

Sedimentation – principles of coagulation-flocculation, clarifier coagulants - Filtration – theory – working of slow and rapid gravity filters disinfection – theory of chlorination, chlorine demand, other disinfection practices- Miscellaneous treatment methods.

UNIT 3 **8 hours**

Distribution systems – Gravity system – Pumping system – Dual system – Layout distribution system – Dead End – Grid Iron – Radial systems – Analysis of Pipe networks - Hardy Cross and equivalent pipe.

UNIT 4 **10 hours**

Characteristics of sewage – cycles of decay – decomposition of sewage, examination of sewage – B.O.D. – C.O.D. equations. Introduction to primary and secondary treatment of waste water, sedimentation tanks biological treatment – trickling filters. Sludge digestion – design of Digestion tank – Sludge disposal by drying – septic tanks and Imhoff Tanks working principles and design – soak pits, .Fecal waste and septage management**,** Introduction to government policies and programs- environmental aspects.

UNIT 5 **6 hours**

Sluice Valves – Pressure Relief Valves – Check walls – Meters – Sewer appurtenance - inverted siphon – catch basins –– sanitary fittings-traps – one pipe and two pipe systems of plumbing. sewage pipe network

Environmental Engineering Laboratory

List of Experiments

Cycle –I :

1. Analysis of pH ; Conductivity; Turbidity
2. Analysis of Acidity; Alkalinity
3. Analysis of Total Hardness; Calcium Hardness
4. Analysis of Available chlorine; Residual chlorine
5. Conducting Jar test for determining optimum dosage of coagulant
6. MPN –Calculation, Demo only

Cycle –II :

7. Determination of Total Solids, Total Dissolved Solids &Settleable Solids
8. Determination of Phosphates & sulphates.
9. Determination of Dissolved Oxygen
10. Determination of Biochemical Oxygen Demand (Demo only).
11. Determination of Chemical Oxygen Demand (Demo only).

Text Books:

1. Water supply and sanitary engineering by G.S. Birdi, Dhanpat Rai & Sons publishers,2014
2. Water Supply Engineering, Vol-I & Waste water engineering, Vol-II, P.N.MODI, STANDARD Book House, 2016

References:

1. B.C. Punmia, Ashok Jain & Arun Jain, Laxmi Publications Pvt. Ltd, New Delhi,

2. Elements of environmental engineering by K.N. Duggal, S. Chand Publishers.
3. https://nptel.ac.in/courses/105104102/
4. https://nptel.ac.in/courses/105105048/
5. Standard methods for the examination of water and wastewater. (2012). 21st Edition, Washington: APHA.
6. Indian standard Drinking water –specifications,2nd Revision ,IS 10500:2012
7. Guidelines for water quality management –CPCB ,2008
8. Guidelines for drinking- water quality,4TH EDITION,2017
9. B. Kotaiah and Dr. N. Kumara Swamy, Environmental Engineering Laboratory Manual, Charotar Publishing House Pvt. Ltd., 1st Ed., 2007.

Course Outcomes:

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

1. analyse the quality for water based on Indian standards-L3
2. understand the water treatment units –L3
3. analyze and interpret the pipe networking systems –L4
4. calculate various design parameters of waste water treatment –L3
5. explain the functions of various sanitary fittings –L4

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2				3					2	3	3	1
CO2	3	2	2				3	2				2	2	2	1
CO3	2	2	3			1							2	3	2
CO4	2	3	2				2	2				2	2	2	1
CO5	2	2	2		2	2			1	1		2	2	2	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2061	WATER RESOURCES ENGINEERING	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course helps the learner to acquire the comprehensive knowledge of physical process of surface and ground water hydrology and able to apply the principles to estimate the runoff resulting from rainfall. The learner will be able to determine the safe yield from a well. This course introduces the concept of flow mass curve to determine the required capacity of reservoir. This course illustrates the systems and methods of irrigation. The learner will gain the knowledge of silt theories to design an unlined canal.

Course Educational Objectives:

- to teach the physical process of surface and ground water hydrology
- to illustrate the principles of rainfall-runoff relationship.
- to provide an over view to solve the problems related to hydrograph analysis, well hydraulics, reservoir capacity.
- to impart the skill to design the canal capacity for crop water requirement and design of unlined canal.

UNIT 1 Hydrology 9hours

Hydrologic cycle, precipitation, types of rainfall and its measurement, computation of mean depth of rainfall over an area, double mass curve; evaporation and cevapi-transpiration, infiltration, infiltration indices W-index, ø - index.

UNIT 2 Hydrograph Analysis and Ground Water Hydrology 9 hours

Hydrograph Analysis: runoff, methods of determination of runoff, Storm hydrograph, Unit hydrograph, applications of unit hydrograph, hydrograph of different durations, S-hydrograph.

Ground Water Hydrology: Types of aquifers, Darcy's law, well hydraulics, steady flow into wells in un-confined and confined aquifers, recuperation test method for determination of yield of an open well.

UNIT 3 Reservoir Planning 8 hours

Investigations for reservoir planning, selection of site for a reservoir, zones of storage in a reservoir, reservoir yield, mass curve and demand curve, determination of reservoir capacity, yield from a reservoir, reservoir sedimentation, control of reservoir sedimentation, useful life of a reservoir.

UNIT 4 Irrigation 8 hours

Introduction of irrigation, types of irrigation systems, methods of irrigation: surface, sub-surface and sprinkler methods, drip irrigation; soil moisture constants, depth and frequency of irrigation, water requirements of crops, duty, delta, base period and their relationship, crop seasons, factors affecting duty, consumptive use of water, irrigation efficiencies.

UNIT 5 Canal Systems 8 hours

Classification of irrigation canals, canal alignment, , determination of canal capacities for cropping patterns, regime silt theories, design of unlined canals, Kennedy's and Lacey's theories, unlined canal design problems, cross section of a canal, balancing depth of canal.

Text Books:

1. B. C. Punmia and Pande B. B. Lal, Irrigation and Water Power Engineering, 16/e, Laxmi Publications Pvt. Ltd., New Delhi, 2021
2. P.N.Modi, Irrigation, Water Resources and Water Power Engineering, 11/e, Standard Book House, Delhi, 2020

References:

1. S. K. Garg, Irrigation Engineering, and Hydraulic Structures, Khanna Publishers, Delhi
2. K.R. Arora, Irrigation, Water Power and Water Resources Engineering, Standard Book Publishing, Delhi
3. Jayarami Reddy P., Engineering Hydrology, Laxmi Publications Pvt. Ltd., Delhi, 2016
4. Chow V.T., D.R Maidment and L.W. Mays, Applied hydrology, Tata McGraw Hill Education Pvt Ltd, Delhi, 2017.
5. Mays L.W, Water Resources Engineering, Wiley India Pvt. Ltd, 2013

Fluid Mechanics and Water Resources Engineering NPTEL Course:
https://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/fluid_mechanics/index.htm
https://nptel.ac.in/courses/105105110/

Course Outcomes:

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

1. estimate the storm water runoff resulting from rainfall (L-3)
2. determine the safe yield from a well (L-3)
3. determine the reservoir capacity and useful life of reservoir (L-3)
4. compute the discharge requirement for cropping patterns (L-3)
5. design the unlined canal using silt theories (L-3)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3				2	2		1			1			
CO2	3	3	2	2		2	2		1			1	2	1	
CO3	3	3	2	2		2	2		1			1	2	1	
CO4	3	3	2	2		2	2		1			1	2	1	
CO5	3	3	2	2		2	2		1			1	2	1	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2071	CONSTRUCTION MATERIALS & CONCRETE TECHNOLOGY	L	T	P	S	J	C
		2	0	2	0	0	3
Pre-requisite	**Nil**						
Co-requisite	**Nil**						
Preferable exposure	**Nil**						

Course Description:

This course deals with different kinds of construction materials used in Civil Engineering. It also discusses about the properties of concrete which is a widely used as a Construction material. This course is a pre requisite for design courses such as Design of Reinforced Concrete Structures and Advanced Design of Reinforced Concrete Structures. This course gives confidence for the learners in judicious selection of materials used in the construction industry.

Course Educational Objectives:

- To familiarize with the basic construction materials.
- To help in deciding the suitability of the materials in construction.
- To demonstrate the gradation of aggregates as construction materials.
- To enable the conduct of workability tests of concrete.
- To train on mix design for concrete.

UNIT 1 Stones and Bricks and Wood 5 hours
Construction Materials

Stones and Bricks -Properties of building stones, classification of stones, stone quarrying, various types of bricks and blocks used for construction, tests on bricks and blocks
Wood: Classification of various types of woods used in buildings, Timber – Market forms – Industrial timber

UNIT 2 Foundations, Masonry, Wall and Finishings 5 hours
Structural system-load bearing structure- framed structure- load transfer mechanism
Foundations – Deep and Shallow foundations
Masonry -Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry.
Wall: Load bearing wall, partition wall, shear wall
Finishings- Damp Proofing and water proofing materials and uses, Plastering Pointing, white washing and distempering.

UNIT 3 Cement and Aggregates 6 hours

Cement: Portland cement – chemical composition – Hydration, Setting of cement – Structure of hydrate cement – Test on physical properties – Types and different grades of cement.

Aggregates: Classification of aggregate Particle shape & texture –, strength &other mechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Soundness of aggregate – Sieve analysis – Fineness modulus Grading curves – Grading of fine & coarse Aggregates

UNIT 4 Fresh Concrete and Admixtures 6 hours

Fresh Concrete: Process of manufacture of concrete, quality of mixing water, properties of fresh concrete, workability, factors affecting workability, measurement of workability.

Admixtures: Benefits of admixtures, types of admixtures, accelerating admixtures, retarding admixtures, water-reducing admixtures, super plasticizer.

UNIT 5 Strength of Concrete and Mix Proportions 6 hours

Strength of Concrete: Water/cement ratio, effect of age and specimen size on strength of concrete,

Mix Proportions: Factors in the choice of mix proportions – Proportioning of concrete mixes by– IS 10262- 2009 and IS 456.

Construction Materials &Concrete Technology Laboratory

Material Tests

1. Compression test on Stones, Solid and Hollow Blocks.
2. Determination of fineness of two types of cements by sieving and Blain's apparatus.
3. Determination of consistency of cement and setting time of two types of cement. IS 4031(Part 5)
4. Determination of specific gravity of two types of cement(IS:4031-PART 11)
5. Determination of compressive strength of two types of cements.IS 4031(Part 6) & IS 4031(Part 7)
6. Grading of fine and coarse aggregate by conducting sieve analysis.
7. Determination of specific gravity and bulking characteristics of fine aggregate.
8. Determination of workability of design mix concrete of specific grade by slump cone test.IS: 1199
9. Designing a concrete mix of a particular grade for a target slump using superplasticizers.
10. Determination of workability of design mix concrete of specific grade by compaction factor apparatus.IS: 1199
11. Determination of workability design mix concrete of specific grade by Vee Bee Consistometer. IS: 1199
12. Determination of unit weight, water absorption and compressive strength of design mix concrete of specific grade. IS 516.

13. Determination of split tensile strength (IS 516) and modulus of rupture of plain concrete beam (IS 5816).

Text Book(s) :

1. S.C. Rangwala, Engineering Materials, 4/e, Charotar Publishing House, 2017.
2. M.S. Shetty, Concrete Technology,8/e, S.Chand and Company Ltd, 2018.
3. B.S Raghuwanshi, A course in WorkshopTechnology,DhanpatRai&Co,2015.
4. Anurag A. Kandya, Elements of Civil Engineering, Charotar Publishing house,2011.

References:

1. Satheesh Gopi, Basic Civil Engineering, Pearson Publishers,2009.
2. Rangwala, Essentials of Civil Engineering, Charotar Publishing House,2012.
3. **IS1121(part-I):1974(2008)**Methods of Test for Determination of Strength Properties of Natural Building Stones Part I Compressive Strength (First Revision)
4. **IS 1077:1992 (2007)** -Common Burnt Clay Building Bricks – Specification(Fifth Revision)
5. **IS :4031 (Part 4)- 1988 (1995)**Methods of Physicaltestsfor Hydraulic Cement Part 4 Determination Of Consistency Of Standard Cement Paste (First Revision)
6. **IS 4031(Part-I):1996 (2005**)Method of Physical Tests for Hydraulic Cement-Part 1 - Determination of Fineness by Dry Sieving (Second Revision)
7. **IS : 4031 (Part 5) – 1988 (2005**) Methods of Physical Tests for Hydraulic Cement - Part 5 Determination of Initial and Final Setting Times (First Revision)
8. **IS : 4031 (Part 6) – 1988(2005)**Methods of Physical Tests for Hydraulic Cement - Part 6 Determination of Compressive Strength of Hydraulic Cement other than Masonry Cement.
9. **IS 1383:1970 (2002)**Specification for Coarse and Fine Aggregates from Natural Sources for Concrete (Second Revision)
10. **IS: 2386 (Part III) – 1963 (2002)**Methods Of Test For Aggregates For Concrete Part Ill Specific Gravity, Density, Voids, Absorption and Bulking
11. IS 10262: 2009 –Concrete Mix Proportioning Guidelines
12. **IS : 1199 -1959 (2004)**Methods of Sampling and Analysis of Concrete (Eleventh Reprint November 1991)
13. **IS : 516 – 1959 (2004)**Methods of Tests for Strength of Concrete (Eighteenth Reprint June 2006)
14. **IS 5816: 1999 (2004**) Splitting Tensile Strength of Concrete - Method of Test (First Revision)
15. P.C. Varghese, A Text Book Building Materials, 2/e, Prentice-Hall, Publication, 2015.
16. 2. A.M. Neville and J.J. Brooks, Concrete Technology,2/e,Pearson Education, Noida, Uttar Pradesh,2019.
17. 3. P.K.Mehta, Concrete: Microstructure, Properties and Materials, 4/e, McGraw-Hill Education, 2014.
18. 4. A.R.Santha Kumar, Concrete Technology, 2/e, Oxford University Press India, 2018.

19. 5. http://textofvideo.nptel.ac.in/105102012/lec41.pdf

20. 6. https://nptel.ac.in/courses/105102088/

Course Outcomes:

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

1. list the construction materials in Civil Engineering (L1).
2. summarize types of foundations and walls(L2).
3. list different types of cement(L1).
4. Explain the behaviour of fresh concrete(L2).
5. Design concrete mixes as per coral provisions (L3)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1			1	1	1				3	1	3	2
CO2	2	2	1			1	1	1				3	1	3	2
CO3	3	2	2	1	2	1	1	1	1			3	1	3	2
CO4	3	2	2	1	2	2	2	1	2	1		3	1	3	2
CO5	3	3	2	1	2	2	2	1	3	2		3	1	3	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2081	GEOTECHNICAL ENGINEERING	L	T	P	S	J	C
		3	0	2	0	0	4
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Knowledge on Geology**						

Course Description:

GTE is an essential interdisciplinary course in civil engineering. Soil has been used as a foundation supporting medium as well as an excellent material for construction of embankments, earth dams, canal levees etc. Improvement of engineering performance of soil is important for compacted engineered fills. Identification, classification and characterization is very important aspect when soil is used as a construction material. Soil behaviour under loads, compressibility, Settlement prediction and shear strength aspects play a vital role in the design of sub-structure and long term stability of structures. It could be an essential prerequisite for foundation engineering course.

Course Educational Objectives:

- To expose the aspects of origin, formation of Soils to classify the soil as a construction material.
- To study the flow through soils and understanding the importance of effective stress in the soil behaviour and stability.
- To enable the estimation of Critical Hydraulic Gradient on permeable foundations
- To acquaint the calculation of the settlements in clayey soils.
- To demonstrate the shear strength parameters at different drainage conditions in an attempt to simulate short term and long term stability.

UNIT 1 Soil Properties, Consistency Limits and Classification 9 hours

Soil Properties: Origin and formation of soils, General types of soils, residual and transported soils, three phase representation of soil mass, physical properties of soil – void ratio, porosity, degree of saturation, water content, module weights, specific gravity – their functional relationships, relative density.

Consistency Limits: Determination and various indices – plasticity index, consistency index, liquidity index – uses and applications of consistency limits in soil engineering, activity ratio.

Classification: I.S and MIT grainsize classification, Indian standard classification for fine grained and coarse grained soils for general engineering purposes.

UNIT 2 **Soil Hydraulics** **8 hours**

Types of soil water, Darcy's law and its limitations ,determination of coefficient o permeability, laboratory methods-constant head and variable head permeameter tests factors influencing coefficient of permeability, permeability of stratified soils, stress principle for saturated soils-total, neutral and effective stresses, no flow, downward flow and upward flow conditions, quick sand conditions, critical hydraulic gradient, piping failures in dams founded on permeable formations

UNIT 3 **Stress Distribution** **8 hours**

Bossiness's theory for the determination of vertical stresses due to point loads, assumptions and validity, extension to circular loaded areas, equivalent point load method,2 : 1 approximate method, Vestergaard's theory& equation, Newmark's influence chart - construction and use, contact pressure distribution beneath rigid footings.

UNIT 4 **Consolidation and Compaction** **9 hours**

Consolidation: Oedometer Tests, e-p and e-log p curves – compression index, coefficient of compressibility and coefficient of volume change, Terzaghi's assumptions for one dimensional consolidation, equation and application, coefficient of consolidation, degree of consolidation vs time, initial compression, primary compression and secondary compression, normally consolidated, over consolidated and under consolidated clayey deposits, **Compaction**: Mechanism of compaction, factors affecting compaction, effect of compaction on engineering properties of soils, field compaction equipment and quality control.

UNIT 5 **Shear Strength of Soils** **8 hours**

Stress at a point, Mohr circle of stress, Mohr-coulomb's failure theory, shear tests – direct shear box, unconfined compression, tri-axial compression, and field vane shear tests, shear parameters, types of shear tests in the laboratory based on drainage conditions, shear strength of sands, critical void ratio, thixotropy and dilatancy of sands

Geotechnical Engineering Laboratory

List Of Experiments:

1. Determination of water content by Oven drying and Calcium carbide method (rapid).
2. Determination of specific gravity of soil grains by pycnometer and density bottle
3. Determination of grain size analysis by sieve analysis
4. Determination of Atterberg's limits (LL / PL /SL).
5. Determination of field density by core cutter method / sand replacement method.
6. Determination of permeability of soil by falling head /variable head permeameter method.
7. Determination of optimum moisture content and max density by IS light compaction test.
8. Determination of relative density of soils.
9. Determination of shear strength by direct shear test.

10. Determination of shear strength by unconfined compression test for cohesive soils.
11. Determination of shear strength by tri-axial compression test.
12. Differential Free swell Index Test

Demonstration:

1. Determination of co-efficient of consolidation and compressibility of soils by consolidation test.
2. Determination of swell pressure of soil by swell pressure test.

List of IS Codes:

S.NO	NAME OF THE EXPERIMENT	IS CODE
1.	Specific Gravity By Pycnometer Method	IS: 2720 Part 3 – 1980
	Specific Gravity By Density Bottle Method	
2.	Field Density Test - Core Cutter Method	IS:2720 Part 29 -1975
	In situ Density – Sand Replacement Method	IS :2720 Part 28- 1974
3.	Determination Of Density Index (Relative Density) Of Cohesion less Soil	IS:2720 Part 14 – 1983
4.	Liquid Limit Test	IS:2720 Part 5 – 1985
5.	Plastic Limit Test	IS:2720 Part 5 – 1985
6.	Shrinkage Limit Test	IS :2720 Part 6 – 1972
7.	Field Identification And Classification of Soils	IS: 1498 -1970 Any Standard Text Book
8.	Grain Size Distribution By Sieve Analysis	IS : 2720 Part 4-1985
9.	Permeability Test- Variable Head Method	IS:2720 Part 17 -1986
10.	IS Light Weight Compaction Test	IS:2720 Part 7 – 1980
11.	Consolidation Test	IS:2720 Part 15 – 1986
12.	Swell Pressure Test	IS: 2720 Part 41 – 1977
13.	Direct Shear Test	IS :2720 Part 13 – 1986

14.	Unconfined Compressive Strength Test	IS:2720 Part 10 - 1991
15.	Triaxial Shear Test	IS:2720 Part 11 – 1971

Text Books:

1. Dr. K. R Arora,'Soil Mechanics and Foundation Engineering',5th,Standard PublisherDistribbutor,NewDelhi,2020.
2. Gopala Ranjan and A.S.R, Rao, Basic and Applied Soil Mechanics, 2/e, New Age International Publishers, Third edition 2016.
3. S.Mittal&J.P.Shukla, Soil testing for Engineers, Khanna Publications-2012.
4. K.V.S.AppaRao,V.C.S Rao, Soil Testing-Laboratory Testing and Question Bank, University of science Press-2016.

Virtual Labs:

1. http://smfeiiith.vlabs.ac.in/exp1/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab
2. http://smfeiiith.vlabs.ac.in/exp3/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab
3. http://smfeiiith.vlabs.ac.in/exp4/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab
4. http://smfeiiith.vlabs.ac.in/exp2/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab
5. http://smfeiiith.vlabs.ac.in/exp6/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab
6. http://smfeiiith.vlabs.ac.in/exp7/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab
7. http://smfeiiith.vlabs.ac.in/exp9/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab
8. http://smfeiiith.vlabs.ac.in/exp10/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab

References:

1. C. Venkataramaiah, Geotechnical Engineering, New Age International, 2006..
2. M. Braja Das, Principles of Geotechnical Engineering,Cengage Learning, 2013.

NPTEL Links:
Unit-1: https://nptel.ac.in/courses/105103097/1
Unit-2:https://nptel.ac.in/courses/105103097/25
Unit-3:https://nptel.ac.in/courses/105103097/20
Unit-4:https://nptel.ac.in/courses/105103097/37
Unit-5:https://nptel.ac.in/courses/105103097/43

Course Outcomes:

The student will be able to

1. explain Soil behaviour, Gravimetric, Volumetric, Functional interconnecting relationships & phase model concepts. Identify, Classify and characterize the soil as a construction material. –L2
2. illustrate the problems in flow through the soils and acquire knowledge in the importance of Effective Stress Concepts.-L2
3. analyze Stress distribution in Soils, based on elastic theories, analytical and graphical methods.-L3
4. solve Compaction & Consolidation problems and compute the probable long term settlement of structures.-L3
5. determine shear strength parameters by analytical and graphical methods-L2

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	3			3				1	2	2	2
CO2	3	3	1	1	3			3				1	2	2	2
CO3	3	3	2	2	1			2				1	2	2	2
CO4	3	3	2	2	2			3				2	2	2	2
CO5	3	3	2	2	3			3				2	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2091	STRUCTURAL ANALYSIS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The student will be able to analyze statically determinate members such as columns, cylinders and indeterminate structural members such as fixed beams and continuous beams. Various methods for computing deflections in beams and trusses are covered in this course. Design of Reinforced Concrete Structures and Design of Steel Structures require this course as a prerequisite.

Course Educational Objectives:

- To demonstrate calculation of displacements in statically determinate beams and trusses.
- To familiarize with the analysis of indeterminate beams.
- To familiarize with the analysis of continuous beams using various methods.
- To explain the behavior of long columns.
- To facilitate the analysis of cylinders.

UNIT 1 Deflection of Statically Determinate Structures and Deflection of Trusses 8 hours

Deflection of Statically Determinate Structures- Introduction, Relation between curvature, slope and deflection, Deflection curves, Macaulay's Method, Moment area method, Slopes and deflection for cantilevers and simply supported beams

Deflection of Trusses: Deflection of trusses by Unit load method(having 5 members or less)

UNIT 2 Analysis of Indeterminate Beams 8 hours

Fixed beams: Shear force and bending moment diagrams for Fixed beams subjected to UDL and point loads

Two span continuous beams: Shear force and bending moment diagrams for two span continuous beams using Slope deflection method

UNIT 3 **Analysis of two span continuous beams** **10 hours**

Moment distribution method: Shear force(S.F) and bending moment (B.M) diagrams for two span continuous beams using Moment Distribution Method

Kane's method: Shear force and bending moment diagrams for two span continuous beams using Kain's Method

UNIT 4 **Columns and Struts and Combined bending and direct stresses** **8 hours**

Columns and Struts: Introduction, Column with one end free and other fixed, Column with both ends hinged, column with both ends fixed, column with one end fixed and the other hinged, Limitation of Euler's formula, column carrying eccentric load, Rankine-Gordon formula, Perry's formula.

Combined bending and direct stresses–Introduction, Limit of eccentricity for no tension in the section.

UNIT 5 **Thin Cylinders and Thick Cylinders** **8 hours**

Thin Cylinders - Introduction, Stresses and strains in thin cylinders, volumetric change in cylinder.

Thick Cylinders: Thick cylinders subjected to internal pressure and external pressure, compound cylinders.

Text Books:

1. V.N Vazirani and M.M Ratwani, Analysis of Structures Vol-II, Khanna Publishers,2012.
2. T.S. Thandavamoorthy, Structural Analysis, 2/e, Oxford University press, 2011.

References:

1. C.K.Wang, Statically Indeterminate Structures,TataMcGrawHill,2010.
2. G. Pandit, S. Gupta, Rajesh Gupta,'Theory of Structures (Vol.II)',3, McGraw Hill Education, India, 2017.
3. https://nptel.ac.in/downloads/105101085/

Course Outcomes:

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

1. calculate the deflections in statically determinate beams and trusses (L2).
2. construct SFD and BMD for fixed and two span continuous beams using Slope Deflection Method (L3).
3. construct SFD and BMD for fixed and two span continuous beams using Moment Distribution method and Kanins method (L3).
4. solve buckling load of columns (L3).
5. evaluate the stresses in cylinders(L5).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3							2		1		
CO2	2	2	2	3							2		2		
CO3	2	2	2	3							2			2	
CO4	2	2	2	3		3					2			2	
CO5	2	2	2	3		3					2		1		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3001	DESIGN OF REINFORCED CONCRETE STRUCTURES	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The student will be able to analyze and design various reinforced concrete members subjected to different types of loads using Indian Standard codal provisions. The course is a prerequisite for Advanced Design Reinforced Concrete Structures and Prestressed Concrete.

Course Educational Objectives:

- To impart the concept of working stress method.
- To train on limit state method of design for flexure.
- To train on limit state method of design for shear, torsion.
- To enable the design of one-way and two-way slabs.
- To instill the design of columns.

UNIT 1 **8 hours**

Loading standards as per IS 875, grades of steel and concrete, Introduction to working stress, ultimate load and limit state methods. Working stress method: Assumptions, flexure of RCC beams of rectangular section, under reinforced, balanced and over-reinforced sections, analysis and design of singly reinforced beams of rectangular sections using working stress method

UNIT 2 **Limit State Method** **8 hours**

RCC beams of rectangular sections under flexure, under reinforced, balanced and over-reinforced sections, analysis and design of singly and doubly reinforced beams of rectangular sections;
Design of T beams: effective flange width, analysis and design of T-beams.

UNIT 3 **Shear and Torsion** **8 hours**

Limit state of collapse in shear, types of shear failures, truss analogy, shear, span/depth ratio, calculation of shear stress, types of shear reinforcement, design for shear in beams, analysis for torsional moment in a member, torsion shear stress in rectangular sections, reinforcement for torsion in RCC beams.

UNIT 4 **8 hours**

Design of one-way and two-way slabs (using IS 456),method of analysis, classification of slabs, design of one way simply supported slab, behaviour of two way slab, types of two way slabs, analysis of two way slabs, design of two way slabs with different edge conditions.

UNIT 5 **Columns and Footings** **8 hours**

Columns: Short columns, minimum eccentricity, column under axial compression, analysis and design of short columns subjected to uniaxial moment, analysis and design of short columns subjected to bi-axial moments.
Footings: Design of isolated footings for a column subjected to axial loading.

Text Books:

1. Pillai and Menon, Reinforced Concrete Design, 4/e, Tata McGraw Hill, 2021.

References:

1. A.K. Jain, Reinforced Concrete – Limit State Design, 7/e, Standard book house,2012
2. P.C. Varghese, Limit State Design of Reinforced Concrete, 2/e, Prentice Hallof India,2013.
3. N. Subramanian, Design of Reinforced Concrete Structures, Oxford University, 2014.
4. https://nptel.ac.in/courses/105105105/1
5. https://nptel.ac.in/downloads/105105104/

Course Outcomes:

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

1. design of RCC beams using working stress method (L3).
2. design of RCC beams using Limit State Method (L3).
3. design of RCC beams for shear & Torsion (L3).
4. Design of one-way and two-way slabs (L3).
5. design of short columns & isolated footings (L3).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	3		1	3	1	2		3		1	2	2	2
CO2	1	3	3		1	3	1	2		3		1	2	2	2
CO3	1	3	3		1	3	1	2		3		1	2	2	2
CO4	1	3	3		1	3	1	2		3		1	2	2	2
CO5	1	3	3		1	3	1	2		3		1	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

<table>
<tr><td rowspan="2">CIVL2101</td><td rowspan="2">HIGHWAY ENGINEERING</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>2</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">None</td></tr>
<tr><td>Co-requisite</td><td colspan="7">None</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">None</td></tr>
</table>

Course Description:

Highway engineering is a very diverse and multidisciplinary field, which deals with the planning, design, operation and maintenance of transportation systems .The course aims to make the students learn the principles of highways, their components and design of flexible and rigid pavements. Further, students will get acquainted with treatment for failures and remedial measures during maintenance of pavements.

Course Educational Objectives:

The purpose of this course is to

- Impart knowledge on the history and current trends in highway development
- explain concepts of geometric design related to roads along with their applications
- familiarize about different materials used for the highway construction along with their properties
- instruct the types of pavements along with their design procedures, construction and maintenance
- train traffic related information on highways

UNIT 1 Highway Development and History of Roads 8 hours

History of development of roads, highway development in India, classification of roads, planning surveys, highway alignment, engineering surveys for highway alignment.

UNIT 2 Highway Geometric Design 9 hours

Highway cross-sectional elements, stopping sight distance, overtaking sight distance, intermediate sight distance, camber, super elevation, extra widening, setback distance at horizontal curves, design of horizontal curves, transition curves, vertical curves.

UNIT 3 Pavement Materials and Design 9 hours

Highway materials: aggregate properties and tests: crushing, abrasion and impact test, bitumen properties and tests, - penetration, ductility, viscosity, binder content and softening point design of pavements: design of flexible pavement by C B R method as per IRC 37-2012 and theory of empirical mechanistic method, stresses in rigid pavement by Vestergaard's and IRC methods, design of overlay by Benkelman beam method.

UNIT 4 Highway Construction and Maintenance 8 hours

Highway construction: earthen roads, WBM roads, bituminous roads and cement concrete roads, highway maintenance: failure of flexible and rigid pavements and their maintenance, highway drainage: surface and sub surface drainage system.

UNIT 5 Traffic Engineering 8 hours

Traffic characteristics: road user characteristics and vehicle characteristics, traffic studies: traffic volume study, speed studies and origin and destination studies, traffic control devices: signs, signals and markings and traffic islands, intersection: introduction to un-channelized and channelized intersections and rotary intersections.

Highway Engineering Laboratory

List of Experiments

1. Determination of specific gravity and water absorption of aggregates.
2. Gradation test on aggregates.
3. Shape test of aggregates.
4. Determination of impact and compressive strength value of aggregates.
5. Determination of abrasion value of aggregates.
6. Determination of penetration, viscosity and stripping value test on bitumen.
7. Determination of ductility test of bitumen.
8. Determination softening point, flash and fire point test of bitumen.
9. Determination of optimum binder content(Marshall mix design).
10. Traffic volume studies.
11. Spot speed studies.
12. Parking studies.

Note : All laboratory tests are as per IS, ASTM, AASHTO, TRL, IRC, BS procedures specifications and guidelines.

Text Books:

1. Khanna, S.K.,Justo, C.E.G., Veeraragavan. A. Highway Engineering, NemchandandBros,Roorkee, 2015
2. Fred L. Mannering , Scott S. Washburn Principles of Highway Engineering and Traffic Analysis, 7th Edition, John Wiley & Sons, 2020

References:

1. Roger P. Roess, Elena S. Prassas, William R. McShane,'Traffic Engineering',Pearson,2019
2. C. JotinKhisty and B. KentLal, Transportation Engineering', Pearson India, 2016.
3. D.V. Bhavanna Rao G. Venkatappa Rao, K. Ramachandra Rao, KausikPahari,'Highway Material Testing and Quality Control', Wiley, 2019.
4. Khanna, S.K.,Justo, C.E.G., Veeraragavan. A, Highway Material Testing, 4/e, Nem Chand and Bros, Roorkee, 2013
5. W. R. Mc Shane, and R.P. Roess, Traffic Engineering, Prentice Hall, 2010

Course Outcomes:

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

1. explain highway development and classify roads and highway alignment.[L2]
2. categorize highway geometrics for different conditions[L4]
3. evaluate a flexible and rigid pavement[L5]
4. apply the principles of highway construction, maintenance and drainage systems[L3]
5. acquire knowledge on traffic characteristics, traffic studies, traffic control devices and intersections[L3]

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						3				2	2	2			
CO2	2	3	3	3	3	3			2	2			2	2	
CO3	2	3	3	3	3	3			2	2					
CO4		3		3	3				2	2	2		2	2	
CO5	2	3		3	3	3			2	2	2		2	2	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2111	ESTIMATION AND COSTING	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The primary purpose of estimating and costing is the preparation for submission of a project according to administrative approval and technical sanction. The various elements of engineering involved in it viz. planning, preparing bill of quantities and abstracts of cost, drawing and detailing (specially at the actual construction stage) and organization of labor and material with a view to provide a durable structure most economically.

Course Educational Objectives:

- To explain the basics terms and standard units used in construction of civil engineering structures.
- To demonstrate the different methods of estimating the quantities of items.
- To familiarize the schedule of rates of different item of works by using standard data book.
- To explain the estimation of earthwork in different roads and also calculate the weight of steel required in R.C.C. element.
- To familiarize about construction contracts and tenders.

UNIT 1 **Introduction** **8 hours**

Introduction: General items of work in building, standard modules, principles of working out quantities for detailed and abstract estimates, approximate method of estimating, errors in estimation, types, related terms in estimate, contingencies, different types of approvals, rules.

Specification: purpose and basic principle of general and detailed specification (writing the detailed specification for various constructions should be covered in term work).

UNIT 2 Detailed Estimate of Buildings 8 hours

Different items of works in building, detailed measurement form, estimate of RCC building long wall- short wall method and Centre line method.

UNIT 3 Rate Analysis 9 hours

Working out of data sheet for materials and various items of work in buildings, standard data book, schedule of rates, and abstract estimate of buildings.

UNIT 4 Roads and Bar bending 9 hours

Roads: Estimation of earth work, different formulae for calculations, concrete roads, bituminous roads.

Bar bending: Introduction to bar bending schedule, beams.

UNIT 5 Contracts and Tender 8 hours

Contracts: Definition, element of contract, offer acceptance and consideration, valid contract, types of contracts, conditions of contract, sub-contracts, joint ventures, muster roll form 21, piecework agreement form, work order.

Tender: Definition quotation, earnest money- security money, tender notice, tender form, bidding types and procedure, irregularities in bidding, award, arbitration- disputes settlement.

Text Books:

1. S. C. Rangwala, Estimating, Costing and Valuation, 17/e ,Charotar Publishing House, 2017.
2. B.N. Dutta, Estimating and Costing in Civil Engineering, 27/e, UB Publishers, 2014.

References:

1. V N Vazirani& S P Chandola, A Text book of Civil Engineering Estimation and Costing, 3/e, Khanna Publishers, 2001.
2. D.D. Kohli and R.C. Kohli, Textbook on Estimating, Costing and Accounts (Civil), 13/e , S. Chand & Company Pvt. Ltd, 2013.
3. M. Chakraborti, Estimation Costing Specifications and Valuation in Civil Engineering, 24/e , Khanna Publishers, 2014.

4. Kumar Neeraj Jha, Construction Project Management: Theory and Practices, 2/e, Pearson Education, 2015.
5. NPTEL Web Course- Construction Planning and enagement https://nptel.ac.in/courses/105103093

Course Outcomes:

At the end of the Course the Students will be able to

1. find out the dimensions and descriptions of construction work in a methodical way.[L-1]
2. interpret the purpose of estimating and quantify the materials by standard method in construction projects.[L-2]
3. construct the different items of materials, labour and machinery with standard unit rates for a various construction work in building.[L-3]
4. interpret the quantities of estimating the road work and bar-bending schedule.[L-2]
5. illustrate the procedure of contract by process of bidding. [L-2]

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2							2		1		
CO2	2	2	3	2							2		2		
CO3	2	2	3	2							2			2	
CO4	2	2	3	2		3					2			2	
CO5	2	2	3	2		3					2		1		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3011	DESIGN OF STEEL STRUCTURES	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	Mechanics of solid						
Co-requisite	structural analysis						
Preferable exposure	structural analysis						

Course Description:

The design of structural members using steel as a construction material will be studied in this course. The student will be able to design various types of structural members such as tension members, compression members, flexural members and their connections using Indian Standard code provisions. The course is a prerequisite for Design of Advanced Steel Structures

Course Educational Objectives:

- To explain the design of bolted connections.
- To explain the design of welded connections.
- To demonstrate the behavior and design of tension members
- To enable the design of compression members.
- To impart the design of flexural members.

UNIT 1 General and Bolted Connections 8 hours

General: Fundamental concepts of design of structures, Types of structural steel – Mechanical properties of structural steel, Indian standard rolled steel sections, Design process, Steel Structural systems, Loads & load combinations, Concept of Working stress and limit state method of design.

Bolted Connections: Types of fasteners, Bolts & Bolted Connection, Failure of a joint, strength and efficiency of a joint, Design of lap joint, butt joint and eccentric connections.

UNIT 2 Welded Connections 8 hours

Types of welds, stresses in welds, design of welded joints subjected to axial load, eccentric welded connections.

UNIT 3 Tension Members 8 hours

Types of tension members and sections, behaviour of tension members, Modes of failures, net effective sectional area for plates and angle sections, design of tension members using plates, single angles and double angles, lug angles.

UNIT 4 Compression Members 10 hours

Types of compression members and sections, Behaviour and failures of Compression members, Effective length, radius of gyration and slenderness of compression members, design compressive stresses in compression, design of struts, design of axially loaded compression members, built up compression members (I section and two channels) laced and battened columns, design of eccentrically loaded columns.

UNIT 5 Beams 8 hours

Introduction, Types of steel beam sections, Classifications of sections, lateral stability of beams, factors affecting lateral stability, behavior of simple beams in bending, design strength of laterally supported & unsupported beams, design of laterally supported and unsupported beams.

Textbooks:

1.S.K. Duggal, Limit state Design of Steel Structures, 3/e, Tata McGraw Hill, 2019.
2. N. Subramanyam, Design of Steel Structures, 3/e, Oxford University Press, 2018.

References:

1. V.L. Shah and Veena Gore, Limit State Design of steel structures IS:800- 2007, Structures Publications,3/e, 2012.
2. M.L. Gambhir, Fundamentals of Structural Steel Design, McGraw Hill Education, 2013.
3. Ramachandra and V. Gehlot, Design of Steel Structures, 2/e, Scientific Publishers, 2015.
4. Shiyekar M R, Limit State Design in Structural Steel, 3/e, Prentice Hall of India Pvt Ltd, 2017.
5. https://nptel.ac.in/courses/105106112/3

Course Outcomes:

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

1. design of bolted connections (L3).
2. design of welded connections (L3).
3. design of tension members (L3).
4. design of compression members using rolled steel and built up sections (L3).
5. design of flexural members using rolled steel sections (L3).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	1	3	1	2	1	1	1	1	2	2	2
CO2	2	3	3	2	1	3	1	2		1		1	2	2	2
CO3	2	3	3	2	1	3	1	2		1		1	2	2	2
CO4	2	3	3	2	1	3	1	2		1		1	2	2	2
CO5	2	3	3	2	1	3	1	2		1		1	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2121	ADVANCED SURVEYING TECHNIQUES	L	T	P	S	J	C
		0	0	4	0	0	2
Pre-requisite	CIVL2031 - Surveying						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Course Educational Objectives:

The purpose of this course is to

- Familiarize concept geography and maps.
- expose to the Modern Surveying tools and techniques
- Focus about different available data resources of GIS & RS Data
- Study the characteristics of concept of GIS
- Study the characteristics of concept of Remote sensing

UNIT 1 Basics of Geography, Maps and Projections: 6 hours

Map, Map scale, Classes of maps, Mapping process, Plane Coordinate systems and transformations, Geographic Co-ordinate systems on earth, Map projection, Classification of map projections

UNIT 2 Modern Field Survey Systems 12 hours

Principle of Electronic Distance Measurement, Types of EDM instruments, Total Station – Parts of a Total Station – Advantages and Applications, Field Procedure for total station survey; Global Positioning Systems Segments, GPS measurements, Surveying with GPS, Co-ordinate transformation, introduction to LiDAR and Drone Surveying

UNIT 3 Data Resources 12 hours

Google Maps, Google Earth, Bhuvan, SoI Toposheets, ISRO

UNIT 4 Remote Sensing: 12 hours

Introduction Definitions of remote sensing and related terminology, Principles of remote sensing, components of remote sensing, Energy source and electromagnetic radiation, Energy interaction, Spectral response pattern of earth surface features. Classification of Remote Sensing Systems, Space Programs across the world

UNIT 5 Geographic Information Systems 14 hours

Introduction-Definitions of GIS - The Evolution of GIS, Components of GIS, Major application areas of GIS, Map scale, Classes of maps, The Mapping process, Plane Coordinate systems and transformations, Geographic Co-ordinate systems on earth, Map projection, Classification of map projections

Text Books:

- B.C. Punmia, Surveying Vol. III, Laxmi Publications, 2005
- Kumar, S, Basics of Remote Sensing and GIS, University Science Press, 2016

References

- NPTEL Web course on Remote Sensing: https://nptel.ac.in/courses/105108077/
- NPTEL Web course on GIS in Civil Engineering: https://nptel.ac.in/courses/105102015/

Course Outcomes:

After successful completion of the course, the student will be able to:

- Familiarize concept geography and maps.
- Summarize the basic principles of GPS and total station, EDM in civil engineering
- Students able to memorize the basic principles of remote sensing
- Students able to memorize the basic principles of geographical information systems

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 0	PO 10	PO 11	PS 12	PSO 1	PSO2	PS O3
CO1	3	3	3		3				3	3			3	3	3
CO2	3	3	3		3				3	3			3	3	3
CO3	3	3	3		3				3	3			3	3	3
CO4	3	3.0	3		3				3	3			3	3	3
CO5	3	3	3		3				3	3			3	3	3

APPROVED IN:

BOS :04-07-2022 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2131	COMPUTER APPLICATIONS IN CIVIL ENGINEERING LABORATORY	L	T	P	S	J	C
		0	0	6	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The student gets familiarity in i)analysis and design of RCC and steel Structure using STAAD Pro., ii)design water distribution network using EPANET, iii)schedule and plan a project using Construction Management principles, and iv) reading of spatial data using GIS. The student will be able to perform design of real time structures.

Course Educational Objectives:

- To demonstrate the modeling of a building.
- To train in generating the maps using GIS software.
- To demonstrate the design of water distribution network.
- To facilitate project planning and scheduling.

List of Analysis or Design to be performed using Various software Spadaro

1. Introduction to STAAD Pro software and basic beam analysis.
2. Analysis of RC plain and three-dimensional frames.
3. Analysis and design of structures subjected to wind and earthquake loads. (minimum five story).
4. Typical detailing of structural elements.
5. Analysis and design of steel truss.
6. Design of structural components – Slabs, Footings, Pile caps, Retaining walls

Geographic Information System (GIS)

1. Creation of spatial data using different methods.
2. Creation of Maps with different data formats.
3. Analysis of data using GIS.
4. Generation of reports based on specific queries.

EPANET

1. Calculation of major head loss in pipes
2. Calculation of minor head losses for bends and fittings.
3. Design of a simple pipe network
4. Analyzing the movement of a tracer material
5. Conducting water quality simulation

Construction Management Applications

1. Introduction to project management software (MS Projects/Primavera)
2. Planning and Scheduling of residential project using PERT and CPM Techniques.
5. Resource Allocation for activities of residential project
6. Controlling the time schedule of residential project.
7. Generating reports for residential project

Note: Students should learn any three software packages,

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	2	1	1	1	1	1	1	1	3	2	2
CO2	2	2	3	2	2	2	2	2	2	1	1	1	3	3	3
CO3	2	2	2	2	2	2	2	1	2	2	1	2	2	2	2
CO4	2	2	3	2	1	1	1	1	1	1	1	1	2	2	2
CO5	2	2	1	2	1	2	2	1	1	1	2	1	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

Program Elective

CIVL1001	BASICS OF GEOGRAPHIC INFORMATION SYSTEMS (GIS)	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course will introduce the basics of Geographic Information System (GIS) and how GIS provides a platform for an efficient way of handling and processing data in real time. The diverse techniques that are used when dealing with different types of analysis, such as vector data analysis and raster data analysis, will also be covered and discussed in the course.

Course Educational Objectives:

- To familiarize with the basic terminology of GIS.
- To understand overall functioning of components in GIS
- To help in identifying sources of vector and raster data.
- To organize and analyze data
- To identify application areas of GIS.

UNIT 1 **8 hours**

Introduction, Information systems, spatial and non-spatial information, geographical concepts and terminology, advantages of GIS, basic components of GIS, commercially available GIS hardware and software, organization of data in GIS.

UNIT 2 **8 hours**

Input data, field data, statistical data, maps, aerial photographs, satellite data, points, lines and areas features, vector and raster data, advantages and disadvantages, data entry through keyboard, digitizers and scanners, digital data, GIS data formats and standards.

UNIT 3 **8 hours**

Data management, data base management system (DBMS), various data models, data analysis, data layers, analysis of spatial and nonspatial data, data overlay and modelling, smart features of DBMS.

UNIT 4 **8 hours**

Applications of GIS in map revision, land use, agriculture, forestry, archaeology, municipal, geology, water resources, soil erosion, land suitability analysis, change detection.

UNIT 5 **8 hours**

A case study in GIS implementation, the consultant, the client, the initial applications, types of GIS analysis used for case study

Textbooks:

1. Basudeb Bhatta, Remote Sensing and GIS, 3rd edition, OUP India, 2021
2. Kang-tsung Chang, Introduction to Geographic Information Systems, Ninth edition, McGraw Hill, 2020

References:

1. Anji Reddy, Text Book of Remote Sensing and Geographical Information Systems, BS Publications/BSP Books, 2012
2. https://nptel.ac.in/courses/105107155
3. https://www.coursera.org/learn/gis

Course Outcomes:

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

1. identify the functional components of a GIS,
2. define system specifications including projections, data and process modelling,
3. organize using appropriate data structures, geographic data within a GIS,
4. analyze and evaluate data and prepare digital databases using GIS software,
5. summarize using maps and tables, the results of GIS based analyses

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					3				3		3		2	3
CO2	3	3			3	3				3		3	1	2	3
CO3	3	3			2	2			3			2	2	2	3
CO4		3			2	2			3			3	2	2	3
CO5		2			3				2			2	2	2	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

		L	T	P	S	J	C
CIVL1011	**Principles of Building Planning – Vastu**	**3**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	None						
Co- requisite	None						
Preferable exposure	None						

Course Description:

Planning is engineer's language. The student will be able to understand layout of site, plan, elevation and section with interior details. This course provides an overview of planning aspects of various buildings as per bye laws. This course is a prerequisite for Estimation and Costing.

Course Educational Objectives:

- To explain the basic architectural principles.
- To introduce the fundamentals of computer aided drawing.
- To familiarize with building bye-laws
- To train to draw the plan, section, elevation and site plan.
- To explain the procedure of understanding the building plans.

UNIT 1 8 hours

Units and Measurements, FPS, SI System, Methods of measurement of length and area - Problems, Plot, Flat, marking lines before construction of building.

UNIT 2 8 hours

Components of a house, standard sizes of rooms, doors, windows, staircases, Types of staircases, Types of buildings , Factors affecting the selection of site, Principles of Planning.

UNIT 3 8 hours

Principles of planning, dimensions of buildings, building regulations and bye-laws for open spaces, orientation of buildings , Parking layout regulations in residential buildings.

UNIT 4 8 hours

Principles of Vastu, Suitable shapes of the sites as per Vastu, orientation of house as per Vasthu. Location of rooms as per Vastu. Number of Doors and Windows, Position of staircases.

UNIT 5 8 hours

Understanding of drawings of building plans, Case studies of various building plans, plan / draw your dream-home.

TextBooks:

1. Gurucharn Singh, Planning Designing & Scheduling, Standard Publishers Distributors, 2018

2. M. V. Chitawadagi and S.S. Bhavikatti, Building Planning and Drawing, I.K. International Publishing House Pvt. Limited 2019

References:

1. N.Kumara Swamy and A.Kameswara Rao, Building Planning and Drawing, Charotar publishers, 2018
1. M.G. Shah, C.M. Kale and S.Y. Patki, Building Drawing with an Integrated Approach to Build Environment, Tata McGraw- Hill Publication, 2018
3. A S Sethupathi, House Plans as per Vastu, 2020

Course Outcomes:

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

1. apply knowledge of building bye laws (L3).
2. demonstrate and draw conventional signs, foundation details, cross section of a door and staircase (L2).
3. construct plan, section and elevation of a residential building (L2).
4. examine the efficiency of CAD design and reading of CAD drawings (L4).

CO-PO Mapping:

4 year UG program:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1	1	2	1	3	1	1	1	1	3	2	3
CO2	1	1	2	2	2	2	2	2	1	1	1	1	3	2	3
CO3	2	2	2	2	2	2	2	2	1	1	1	1	2	1	1
CO4	1	1	2	2	3	1	1	1	1	1	1	1	2	1	1
CO5	2	2	2	2	3	2	1	1	1	1	1	1	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:	
BOS : 13-01-2023	**ACADEMIC COUNCIL: 16-05-2023**
SDG No. & Statement:	
SDG Justification:	

<table>
<tr><td rowspan="2">CIVL1021</td><td rowspan="2">Sustainable Development and Management</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">None</td></tr>
<tr><td>Co-requisite</td><td colspan="7">None</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">None</td></tr>
</table>

Course Description:

Sustainable development agenda has come up in the main agenda of the global research, policy and practice with the conception by the Brundtland commission. The agenda aims at meeting the present generational needs but ensuring that future needs are not compromised. Accordingly, this course focusses on introducing the basic of the agenda of sustainable development, sustainable development goals, various theories that undergird the agenda and a few directions on the assessment/measurement. The course will equip students to develop future goals and objectives in light of the SDGs including framing of their careers, business ideas, questions, objectives, positioning the contributions to the society and nation not only to garner acceptance but also contribute to the industry, policy and practice.

Course Educational Objectives:

- To familiarize the students in the concepts the sustainable development and its underlying concepts sustainability.
- To explain the concept of Millennium Development Goals (MGDs) and Sustainable Development Goals (SDGs).
- To impart knowledge on assessment and measurement of sustainability.
- To demonstrate various management methodologies and techniques in light of sustainability.

UNIT 1 Introduction and History of Sustainable Development 7 hours

Introduction to Sustainable Development: The Brundtland Report, The United Nations Conference in Environment and Development, The World Summit on Sustainable Development; Climate Change: Science, Economics, and Policy;

UNIT 2 Millennium/ Sustainable Development Goals 8 hours

Global climate change issues and responses. Challenges to Sustainable Development: Natural resource depletion and Climate change; Actions of Intergovernmental Panel on Climate Change; Millennium Development Goals (MGDs): the rationale for MDGs and its link with Sustainable Development; Sustainable Development Goals (SDGs).

UNIT 3 **Principles of Sustainability** 8 hours

Principles of Sustainability: the precautionary principle and the safe minimum standard; Sustainability Frameworks, Sustainable Development Indicators; Growth and sustainability: Impact, Population, Affluence and Technology (IPAT) model, ecological footprint, green GDP;

UNIT 4 **Assessment, Design, and Application of Sustainability** 8 hours

Sustainability practice, National Action Plans of developed and developing countries; Methodologies: life cycle assessment (LCA) and Leadership in Energy and Environmental Design (LEED); Design for the Environment, Ecological Principles, Passive Design and Climatic Design; Leadership and management in the age of sustainability.

UNIT 5 **Student Case Studies** 8 hours

Student projects on sustainability applications

Textbooks:

1. Gibson, R. B., Hassan, S., Holtz, S., Tansey, J., & Whitelaw, G. 2005. Sustainability Assessment: Criteria and Processes. London: Earthscan.
2. Gibson, R. B. 2016. Sustainability assessment: Applications and opportunities. London: Routledge. https://doi.org/10.4324/9781315754048.
3. Ghaly, A. M. 2011. Teaching the qualities of leadership and management in the age of sustainability. Leadership and Management in Engineering, 11(2): 113–120.

References:

1. Rogers P P,Jalal, K.F and Boyd, A.J, An Introduction to Sustainable Development, Earthscan, UK, 2007,
2. Daly H.E, Beyond Growth: the economics of sustainable development, Beacon Press, Boston, 1996
3. ISO: 14040 “Environmental management — Life Cycle Assessment — Principles and Framework.” Geneva: ISO, 1997.
4. LEED. “Building Rating System for New Construction and Major Renovations.” Version 2.1. U.S. Green Building Council, 2002. (PDF)
5. WCED Our Common Future (Brundtland Report), Oxford University Press, 1987. World Bank, Report Sustainable Development in a Dynamic World: Transforming Institutions, Growth, and Quality of Life, World Development Report, 2003
6. Franklin, A., & Blyton, P. (Eds.). 2011. Researching Sustainability: A Guide to Social Science Methods, Practice and Engagement. London: Earthscan from Routledge.
7. Gasparini, P., Manfredi, G., & Asprone, D. (Eds.). 2014. Resilience and Sustainability in Relation to Natural Disasters: A Challenge for Future Cities. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-04316-6.
8. IPCC. 2014. Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. (T. Z. and J. C. M. Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, Ed.). Cambridge and New York, United Kingdom and USA.: Cambridge University Press.

Course Further Reading:

1. Gates, Bill (2022) How to Avoid a Climate Disaster, Penguin Books Limited, New Delhi, 9780141993010.

Course Outcomes:

At the end of the course, the student will be able to understand, assimilate, and deploy sustainability concepts in engineering applications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS12	PSO1	PSO2	PSO3
CO1	1		2		1	2	3	1		1	3	2	3		1
CO2	1					2	3	1		1	3	2	3		1
CO3	1	2				2	3	1		1	3	2	3		1
CO4	1		2			2	3	1		1	3	2	3		1
CO5	1		2			2	3	1		1	3	2	3		1

APPROVED IN:	
BOS : 13-01-2023	**ACADEMIC COUNCIL: 16-05-2023**
SDG No. & Statement:	
SDG Justification:	

<table>
<tr><td rowspan="2">CIVL2141</td><td rowspan="2">REPAIRS, RENOVATION AND REHABILITATION OF STRUCTURES</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">None</td></tr>
<tr><td>Co-requisite</td><td colspan="7">None</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">None</td></tr>
</table>

Course Description:

The prerequisite for this course would be Construction Materials and Concrete Technology. The study of this course helps student in identifying the causes for failure of a structure and adopting a suitable repair or rehabilitation technique. The knowledge gained by the students on repair materials and methods learnt helps in finding solution to problems related to maintenance and repair of existing structures.

Course Educational Objectives:

- Identify and define all the terms and concepts associated with deterioration of concrete structures.
- To examine various distress and damages to concrete structures.
- To assess the damage to structures using various field tests.
- To illustrate various types and properties of repair materials.
- To list various repair techniques of damaged and corroded structures.
- Demonstrate the principles of rehabilitation and retrofit techniques.

UNIT 1 Durability and Deterioration of Concrete 8 hours

Durability and Deterioration of Concrete:
Physical causes:
Durability of concrete, causes of distress in concrete structures, Shrinkage in concrete, honeycombing in concrete, creep of concrete, Temperature changes – Internally generated temperature differences, Externally generated temperature differences, Fire on concrete, Thermal movement in concrete,
Corrosion:
Corrosion process, Damages due to corrosion

UNIT 2 Damage Assessment 8 hours

Damage Assessment

Investigation of Damage- Observation, Assessment Procedure

Non-Destructive Testing Methods: Introduction, Non-Destructive Testing Methods, Surface Hardness Test, Ultrasonic Pulse velocity test,

Semi-Destructive Testing Systems: Core Sampling and Testing, Half -Cell potential survey

UNIT 3 Repair Materials 8 hours

Polymeric repair materials, Polymeric coatings, Polymer concrete/mortar composites, Fiber reinforced concrete, Glass fiber reinforced concrete, Polypropylene fiber, Carbon fibers, Fiber reinforced polymer composites, Concrete made with industrial wastes, Bacterial concrete.

UNIT 4 Evaluation and Repair of Cracks 8 hours

Symptoms and Diagnosis of Distress, Evaluation of cracks, Selection of Repair Procedure, Repair of cracks-Preparation of Surface, Repair Techniques, Common types of repairs: Sealing of cracks, Flexible sealing, Providing additional steel, Stitching of cracks, Repair by jacketing, Autogenous Healing.

UNIT 5 Rehabilitation and Strengthening Techniques 8 hours

Rehabilitation Techniques:

Replacement Mortar- Epoxy bonded epoxy mortar, Replacement Concrete- Epoxy-bonded Replacement concrete, Application, Shotcrete or Guinto, Grouting- Portland Cement Grouts, Polymer Grouts, Epoxy Grouting, Resin injection, Sprayed concrete, Slab jacking technique, Cathodic Protection

Strengthening methods:

Introduction-Need for strengthening, Structural Concrete Strengthening, Column Strengthening, Strengthening with external reinforcement, External Post-tensioning, Section Enlargement, Guidelines for Seismic rehabilitation of existing buildings.

Text Books:

1. B.Vidivelli, Rehabilitation of Concrete Structures, 1/e, Standard Publishers Distributors, 2018.
2. M.L.Gambhir, Concrete Technology: Theory and Practice, 4/e, Tata McGraw Hill Education Private Limited, 2013.

References:

1. Peter.H.Emmons and Gajanan.M.Sabnis, Concrete Repair and Maintainence, 2/e, Galgotia Publications Pvt Ltd, 1992.
2. S.Mahaboob Basha, A textbook of Concrete Technology, 1/e, Anuradha Publications, 2011.

3. J.Bhattacharjee, Concrete Structures Repair Rehabilitation and Retrofitting, 1/e, CBS, 2017.
4. P.C.Varghese, Maintenance Repair and Rehabilitation and Minor works of Buildings, 1/e, Prentice Hall India Learning Private Limited, 2014.

Course Outcomes:

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

1. explain the mechanisms of degradation of concrete structures affecting durability(L2).
2. develop a knowhow of the Concrete repair industry equipped with variety of repair materials and techniques(L6).
3. select appropriate repair technique and repair material(L5).
4. decide the appropriate rehabilitation/retrofitting technique for damaged structural members(L5).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3			1		2	2				2	2	2	2	2
CO2	3	2	2	1		2	2				2	2	2	2	2
CO3	3	2	2	1		2	2				2	2	2	2	2
CO4	3	2	2	1		2	2				2	2	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2151	SUSTAINABLE MATERIALS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Educational Objectives:

- To familiarize the concepts of sustainable development.
- To study the building materials for its impact on environment.
- To provide an insight into various Energy Efficient Materials and Sustainable Construction Technology.
- To understand basics of carbon cycle.
- To understand how landscaping can be used in a sustainable manner for modifying microclimate reducing energy and resource use.

UNIT 1 **8 hours**

Fundamentals of Sustainability, Introduction to Life Cycle Design, Three Phases of Building Materials- Pre-Building Phase, Building Phase and Post-Building Phase

UNIT 2 **8 hours**

Features of Sustainable Building Materials- Pollution Prevention Measures in Manufacturing,

Recycled Content. Embodied Energy Reduction, Use of Natural Materials, Reduction of Construction Waste, Local Materials, Energy Efficiency, Water Treatment and Conservation.

UNIT 3 **8 hours**

Key Building Materials and Sources – Limestone, Steel, Aluminum, Bricks and Tile, Petrochemicals, Wood, Basics of Carbon Cycle, Factors Affecting carbon Cycle.

UNIT 4 **8 hours**

Selecting Sustainable Building Materials

Pre-Building Phase: Manufacture - Waste Reduction, Pollution Prevention, Recycled Content, Embodied Energy Reduction, Use of Natural Materials, Building Phase: Use - Reduction in Construction Waste, Energy Efficiency, Water Treatment/Conservation, Use of Non-Toxic or Less-Toxic Materials, Renewable Energy Systems, Longer Life, Post-Building Phase – Disposal-Reusability, Recyclability, Biodegradability.

UNIT 5 **8 hours**

Case Studies - Site and Landscaping, Foundations, Structural Framing, Building Envelopes, Insulation, Glazing, Roofing, Interior Finishes, Flooring. Plumbing, Ventilation.

Text Books:

1) Sustainable Architecture Module: Qualities, Use, and Examples of Sustainable Building Materials, by Jong-Jinn Kim and Jonathan Graves, Published by National Pollution Prevention Center for Higher Education, Michigan

References

1) https://onlinecourses.swayam2.ac.in/arp19_ap75/preview

Course Outcomes:

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

- An understanding on sustainability.
- Knowledge on renewable energy conservation through material usage.
- Insight on environmental impact of building materials.
- Knowledge on Energy conscious Landscape design.
- Knowledge building materials and construction techniques that are sustainable and energy efficient.

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS1 2	PS O1	PSO 2	PSO 3
CO1	2	1	1	0	0	1	3	3	0	0	0	1	1	2	2
CO2	2	2	1	1	0	2	3	3	1	0	0	1	1	2	2
CO3	2	3	2	1	1	2	3	3	1	0	1	1	1	2	3
CO4	2	2	1	1	1	3	3	3	1	0	1	1	1	2	3
CO5	2	2	2	1	1	1	3	3	1	0	1	1	1	2	3

APPROVED IN:

BOS : 04-07-2022 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2161	FOUNDATION ENGINEERING	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**Geotechnical Engineering**						
Co-requisite	None						
Preferable exposure	None						

Course Description:

A foundation is a integral part of the structure which transfer the load of the superstructure to the soil and classified in to shallow and deep foundations. For every structure foundation is essential. There are two major requirements to be satisfied in the design of foundations Provision of an adequate factor of safety against shear failure and Adequate provision against damage to the structure by total or differential settlements. To satisfy these requirements detail investigation of the properties of soil by means of laboratory or field testing. Based on the investigation report type and depth of foundation is suggested, earth pressure calculated, Stability of slope analyzed and bearing capacity also determined

Course Educational Objectives:

- To acquaint the need of Soil Investigation and characterization for structural stability.
- To study the estimation of bearing capacity of soils for shallow foundations and design considerations.
- To study the estimation of Load Carrying Capacity of Piles and well foundations.
- To introduce the determination of earth pressure behind retaining walls. Understand Ground Improvement Methods. Analysis of Slope Stability aspects. (This course does not cover the structural design of foundations.)

UNIT 1 Subsoil Exploration 8 hours

Importance, Methods of subsoil exploration, direct, indirect methods, soundings by standard, dynamic cone and static cone penetration tests, correlations of shear parameters from N values, types of boring, types of samples, criteria for undisturbed samples, bore-logs-preparation, report writing.

UNIT 2 Shallow Foundations 9 hours

Safe bearing capacity and allowable bearing pressure, Terzaghi’s bearing capacity equations its modifications for square, rectangular and circular foundation, types of bearing capacity failures : general, local and punching shear conditions, factors affecting bearing capacity of soil, allowable bearing pressure based on n-values, bearing capacity from plate load tests, causes of settlement, computation of elastic or immediate settlement, allowable settlement, related applications.

UNIT 3 Pile Foundations 8 hours

Classification, use and installation, load carrying capacity of single pile, dynamic formula, static formula, pile load, load capacity of pile groups, average efficiency of pile groups, settlement of pile groups in clays, negative skin friction on plies.

Caissons: Introduction, various forces acting and types of caissons.

UNIT 4 Earth Pressure 8 hours

Types of earth pressures, Rankine's active and passive earth pressures, smooth vertical wall with horizontal backfill, extension to Coulomb's wedge theory, Rheban's graphical method for active earth pressure.

UNIT 5 Stability Analysis of Slopes 8 hours

Introduction, types of slope failures, finiteslopes, Swedish slip circle – ø = 0 analysis, c-ø analysis, friction circle methods of stability analysis, Taylors stability number, factors influencing slope stability

Text Books:

1. Gopala Ranjan and A.S.R. Rao, Basic and Applied Soil Mechanics, New age Publishers, 2000.
2. C. Venkataramaiah, Geotechnical Engineering, New Age Publishers, 2006.
3. Dr. K. R Aurora, Soil Mechanics and Foundation Engineering, Standard Publisher Dist, 2009.

References:

1. V.N.S. Murthy, Soil Mechanics, Foundation Engineering, UBS Publishers, 2011.
2. J.E. Bowles, Foundation Analysis and Design, McGraw Hill, Publishers, 2001.
3. M.D. Braja, Principles of Geotechnical Engineering, 7/e, Cengage Learning: 2013.
4. P.C. Donald, Geotechnical Engineering, Prentice-Hall India, 2010.
5. Rodrigo Salgado, The Engineering of Foundations, McgrawHill, 2006.

NPTEL LINKS

1. **Soil Exploration http://nptel.ac.in/courses/105105039/2**
2. **Shallow foundations http://nptel.ac.in/courses/105107120/**
3. **Pile foundations http://nptel.ac.in/courses/105107120/13**
4. **Earth pressures http://nptel.ac.in/courses/105107120/8**
5. **Stability analysis of soils http://nptel.ac.in/courses/105101084/55**

Course Outcomes:

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

1. **Explain** direct and indirect soil Investigation methods to be adopted prior to construction of structures – **L2**
2. **Determine** bearing capacity of soils for shallow foundations and settlement – **L4**
3. **Estimate** Load Capacities of Pile Foundations and well foundations- **L5**
4. **Estimate** earth pressure behind Retaining Structures, Ground Improvement Techniques – **L5**
5. **Perceive** the Stability analysis of Soil Slopes and arrival of FOS for the natural and manmade slopes – **L5**

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3							2	2	2	2
CO2	3	3	2	1	2							2	2	2	2
CO3	3	3	2	1	2							2	2	2	2
CO4	3	3	2	2	3							2	2	2	2
CO5	2	3	2	1	1							1	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2171	TRAFFIC ENGINEERING	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**CIVL2101- Highway Engineering**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Students will acquire comprehensive knowledge of traffic surveys and studies such as volume count, Speed and delay, origin and destination, Parking, pedestrian and accident surveys. They will achieve knowledge on design of at-grade and grade separated intersections. Students will become familiar with various traffic control and traffic management measures

Course Educational Objectives:

- Provide an insight on traffic and its components, factors affecting road traffic and the design of intersection.
- Explain sampling of data, analysis and interpretation of data in conducting various surveys.
- Demonstrate traffic movements, types of intersections, islands, crossings and their design.
- Enable design of signals and explain the redesigning of existing signals.
- Impart knowledge on traffic regulations, pollution caused by traffic and the method of controlling pollution.

UNIT 1 Introduction 8 hours

Objectives and scope of traffic engineering. Components of road traffic - vehicle, driver and road. Road user characteristics; human and vehicle characteristics, factors affecting road traffic.

UNIT 2 Traffic Engineering 8 hours

Concepts of passenger car units for mixed traffic flow. Traffic Maneuvers. Traffic Stream Characteristics- Relationship between Speed, Flow and Density, capacity, level of service concept.

UNIT 3 Traffic Engineering Studies and Analysis 10 hours

Sampling in traffic studies; adequacy of sample size; application of sampling methods for traffic studies, objectives, methods of traffic study, equipment, data collection, analysis and interpretation (including case studies) of (i) Spot speed (ii) Speed and delay (iii) Volume (iv) Origin - destination (v) Parking.

UNIT 4 Traffic Regulations and Control 8 hours

flow; Other regulations and control. traffic and method of control. General regulations; Regulations on Vehicles, drivers and Traffic management; noise and air pollution due to road.

UNIT 5 Traffic Control Devices 8 hours

Principles of Signal Design, Webster's method of Signal Design, Redesign of Existing Signals including Case Studies; Signal System and Coordination, Evaluation and design of road lighting

Text Books:

1. Kadiyali, L.R., Traffic Engineering and Transport Planning, 9/e, Khanna Publishers, 2018
2. Drew, D.R. Traffic Flow Theory and Control, McGraw Hill Book Co, 1968.
3. Khanna S.K., Justo C.E.G., Veeraragavan A., Highway Engineering, 9/e, Nemchand and Bros, Roorkee, 2017

References:

1. Papacostas, C.A., Fundamentals of Transportation Engineering, 3/e, Prentice-Hall of IndiaPrivate Limited, New Delhi.2001
2. McShane W.R. and Roess R.P., Traffic Engineering, 5/e, Prentice Hall India, 2018
3. Indian Highway Capacity Manual - Indo-HCM 2017
4. NPTEL Web course on Traffic Engineering and Management: https://nptel.ac.in/courses/105101008/

Course Outcomes:

After the completion of the course students should be able to
1. demonstrate components of road traffic, their characteristics and factors affecting road traffic in intersection design **[L2]**
2. apply the knowledge of sampling data in conducting various surveys and analysis **[L3]**
3. interpret traffic movements and designing islands, intersections and road lightings **[L2]**
4. explain design new signals and redesign existing signals **[L2]**
5. summarize traffic regulations, impact of noise pollution, air pollution and the method of controlling them **[L2]**

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2		2					2			2			
CO2	2	2		2					2			2			
CO3	2	2		2					2			2	2	2	
CO4	2	2		2					2			2	2	2	
CO5	2	2		2					2			2	2	2	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2181	HYDRAULIC MACHINES	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The prerequisite for this course would be fluid mechanics. This course introduces the knowledge of application of impulse momentum equation to compute the force exerted by fluid jet on stationary and moving vanes, torque exerted on a wheel with radial curved vanes. This course gives the comprehensive knowledge of hydraulic machines to illustrate the working principles of pumps and hydraulic turbines. The learner will gain the knowledge of unit quantities, specific speed and performance characteristics of pumps and turbines.

Course Educational Objectives:

- to explain the application of impulse momentum equation to compute the force exerted by fluid jet on stationary and moving vanes
- to explain the velocity triangles resulting from impact of jet of an unsymmetrical curved moving vane.
- to impart the concepts to compute the work-done of pumps and turbines.
- to explain the performance characteristics of turbines and pumps.
- to summarize the functionality of various hydraulic machines.

UNIT 1 Impact of free jets on vanes 9 hours

Impulse Momentum Equation – Force exerted by fluid jet on stationary and moving vanes, torque exerted on a wheel with radial curved vanes, velocity triangles.

UNIT 2 Hydraulic Turbines 9 hours

Elements of hydropower plants, classification of turbines – Impulse Turbines (Pelton wheel), Reaction Turbines (Francis, Kaplan) –components, functioning, work done and efficiencies (theory only); applications of draft tube, surge tank.

UNIT 3 Performance of Turbines 8 hours

Performance under unit head and specific conditions, expressions for specific speeds (no derivations), performance characteristic curves, cavitation in turbines, selection of turbines.

UNIT 4 Pumps 8 hours

Rotodynamic Pumps (Centrifugal Pumps) – components, working, types, work done, efficiencies, specific speed (theory only), advantages of centrifugal pumps, pumps in series and parallel.

UNIT 5 8 hours

Functionality and working principles of Mono-block pump, submersible pump, jet pump, Tubular turbine, bulb turbine, lawn sprinkler.
Case Studies related to various Hydraulic Machines *(for internal assessment only)*

Text Books:

1. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics and Hydraulic Machines, 20/e, Standard Book House, 2015.
2. A.K. Jain, Fluid Mechanics, 12/e, Khanna publishers, 2014.

References:

1. K. Subramanya, Hydraulic Machines, Tata McGraw Hill, 2017.
2. L. Victor, Streeter and E. Benjamin Wylie, Fluid Mechanics, 9/e, Tata McGraw Hill,2013.
3. M. Franck White, Fluid Mechanics, Tata McGraw Hill, 2014.

Course Outcomes:

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

1. Draw the velocity triangles resulting from the jet impinged onto a moving unsymmetrical curved vane (L-3).
2. Describe the functioning of impulse and reaction turbines, rotodynamic and positive displacement pumps (L-2).
3. Draw the performance characteristic curves of turbines (L-3).
4. Compute efficiencies of hydraulic pumps (L-3).
5. Describe the significance and working of various hydraulic machines (L-2).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3			2		1	2	3	2		2	2	1	
CO2	3	1			2		1	2	3	2		2	2	1	
CO3	3	3			2		1	2	3	2		2	2	1	
CO4	3	1			2		1	2	3	2		2	2	1	
CO5	3	1			2		1	2	3	2		2	2	1	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2191	WASTEWATER TREATMENT	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Sanitation is one of the most important aspects of community well-being as it protects human health, extends life spans, and is documented to provide benefits to the economy. The main purpose of sanitation is to maintain such environments as will not affect the public health in general. Thus this course provides basic information on functionality of different sewerage systems. Further, helps to learn various design considerations to design all unit operation involved in waste water treatment process and sludge disposal techniques.

Course Educational Objectives:

- to study different sewerage systems and various sewer appurtenances.
- to familiarize with the characteristics of sewage
- to impart the principles involved in primary and secondary treatment of sewage
- to acquaint the decomposition process of sewage under anaerobic and facultative conditions
- to study various disposal techniques in sludge treatment

UNIT 1 Introduction to Sanitary Engineering 8 hours

Sanitation, conservancy and water carriage system, sewerage systems, relative merits, Quantity of sanitary sewage, factors affecting sanitary sewage, determination of quantity of storm water sewage, sewers, sewer appurtenances, sewage pumping, types of sewers, design of sewers, construction; testing, sewer appurtenances manholes, sewage pumping.

UNIT 2 Quality and Characteristics of Sewage 8 hours

Characteristics of sewage, decomposition of sewage, physical and chemical analysis of sewage, problems on BOD. Natural Methods of Wastewater Disposal**,** disposal by dilution, types of receiving waters for dilution, self-purification of natural streams, oxygen sag curves, disposal by land treatment, comparison of disposal methods, sewage sickness; reuse of treated sewage.

UNIT 3 Primary & secondary Treatment of Sewage 11 hours

Screens, grit chamber, grease traps, skimming tanks, sedimentation tanks, Trickling filters and ASP trickling filters, operational problems and remedies, activated sludge process vs. trickling filter process, methods of aeration, diffused air system, mechanical aeration, combined system, sludge bulking, sludge volume index.

UNIT 4 Miscellaneous Methods 8 hours

Septic tank, septic tank effluent disposal, Imhoff tank introduction, oxidation ditch, stabilization pond (oxidation pond), aerobic lagoons, anaerobic lagoons, facultative ponds, Rotating Biological Contractor. (RBC)

UNIT 5 Sludge Disposal & sanitary fittings 7 hours

Anaerobic sludge digestion process, factors effecting sludge digestion, sludge digestion tanks, sludge thickening, sludge conditioning, methods of dewatering the sludge, methods of sludge disposal. Basic Sanitary fittings and functionalities, plumbing systems, maintenance of sanitary installations.

Text Books:

1. P.N. Modi (2008), Sewage treatment & Disposal and waste water Engineering – Environmental Engineering (Vol.II) – Standard Book House
2. Met Calf and Eddy, Wastewater Engineering Treatment, Disposal and Reuse, Tata McGraw Hill, 2010

References:

1. Ruth F. Weiner and Robin A. Matthews (2003), Environmental Engineering,Butterworth- Heineman
2. S.C. Rangwala, Water Supply and Sanitary Engineering,1/e, Charotar, 2005.
3. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous (1995), Environmental Engineering, McGraw HillInc.,NewYork.
4. https://nptel.ac.in/syllabus/105105048/

Course Outcomes:

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

1. differentiate the types of sewerage systems and explain the working principle of every sewer appurtenance –L4.
2. analyze the characteristics of sewage –L4
3. select an appropriate treatment method to design various units in sewage treatment –Ll3
4. test the efficiency of designed treated units under anaerobic condition –L4
5. explain the functionality of sanitary fittings-L4

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2			3					2	3	3	1
CO2	3	2	2	3			3	2				2	2	2	1
CO3	2	2	3	2		1							2	3	2
CO4	2	3	2	2			2	2				2	2	2	1
CO5	2	2	2		2	2			1	1		2	2	2	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS :04-07-2022 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2201	WATERSHED MANAGEMENT	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:
A watershed is an area through which water flows across the land and drains into a common body of water such as a lake or a river. Contamination of the watershed and its surrounding is threatening the ecosystems. It is essential to consider the downstream impacts when developing and implementing water quality protection and restoration actions. This course provides a basic overview of watershed management. Prerequisites for this course are fluid mechanics and water resources engineering.

Course Educational Objectives:
- explain the significance of watershed management
- teach the principles of soil management.
- elucidate the methods of water harvesting
- explain the methods of groundwater recharge
- introduce the case studies on watershed management

UNIT 1 Introduction 8 hours
Concept of watershed, need for watershed management, concept of sustainable development. Hydrology of small watersheds.

UNIT 2 Soil Management 8 hours
Principles of soil erosion, causes of soil erosion, types of soil erosion, estimation of soil erosion from small watersheds. Control of soil erosion, methods of soil conservation – structural and non-structural measures.

UNIT 3 8 hours
Principles of water harvesting, methods of rainwater harvesting, design of rainwater harvesting structures.

UNIT 4 8 hours
Conservation of ground water, methods of artificial recharge of groundwater, methods of artificial recharge, consumptive use of water

UNIT 5 8 hours
Micro farming, biomass management on the farm - Case studies of Watershed Management**.**

Text Books:
1. Muthy, J. V. S., Watershed Management, New Age International Publishers, 2017

References

1. V.V.N. Murty and Madan K. Jha, Land and Water Management Engineering, Kalyani Publishers, 2013
2. Chatterjee, S. N., 1/e, Water Resources Conservation and Management, Atlantic Publishers and Distributors Pvt Ltd., 2018.

Course Outcomes:

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

- Identify the causes of soil erosion (L-1)
- Plan for soil conservation measures in a watershed (L-3)
- Plan and design water harvesting / recharging structures (L-3)
- Plan the measures for reclamation of saline soils (L-3)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3			2	2		3			1	3		
CO2	3	3	3			2	2		3			1	3		
CO3	3	3	3			2	2		3			1	3		
CO4	3	3	3			2	2		3			1	3		
CO5	3	3	3			2	2		3			1	3		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2211	BASICS OF REMOTE SENSING	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

To understand the basic concepts of remote sensing, systems & techniques of data acquisition and to acquire knowledge in image processing techniques and interpretation of remote sensing data. So, that student will become flexible with subject and subject expertise in practical for learning.

Course Educational Objectives:

- To familiarize with the concept of remote sensing
- To familiarize with various types of sensors
- To familiarize with various types of remote sensing platforms
- To understand image interpretation technics
- To understand digital image processing

UNIT 1 Introduction and Basic Principles of Remote Sensing 8 hours

Introduction: Definition of terms, Concepts and types of remote sensing; stages in remote sensing technology, spatial data acquisition.

Basic Principles of Remote Sensing: EMR, EMS, Energy Interaction with earth's atmosphere and earth surface; Definition of radiometry; Black body radiation; Reflectance; spectral reflectance of land covers; Spectral Signatures.

UNIT 2 Sensors 8 hours

Types of sensors- passive sensors and active sensors; Push broom scanners and whisk-broom scanners; Imaging spectrometer; space borne imaging sensors, microwave sensors; Thermal sensors.

UNIT 3 Platforms 8 hours

Types of platforms- airborne remote sensing, space borne remote sensing; Atmospheric condition and altitude; Orbital elements of satellite; Various satellites for Land, Ocean, and atmospheric studies.

UNIT 4 Image Interpretation and Analysis 8 hours

Fundamentals of aerial photos and satellite image interpretation; Types of imaging, elements of interpretation, Generations of Thematic maps. Importance of ground truth, reference data, use of smart phone, geo-tagging.

UNIT 5 Digital Image Processing 8 hours

Data reception and data products, Digital data manipulation and analysis; image rectification – Radiometric correction, Atmospheric correction, Geometric correction.

Text Books:

1. Fundamentals of Remote Sensing: George Joseph
2. Remote Sensing and Image Interpretation: Lillesand &Keifer.

References:

1. Manual of Remote Sensing: ASP Falls Church Virginia USA.
2. Physical aspects of Remote Sensing: PJ Curran.
3. Remote Sensing Principles and Interpretation: F.F. Sabins.
4. Introduction to Remote Sensing: J.B. Campbell.
5. Introductory Digital Image Processing: A Remote Sensing Perspective, John R Jensen.
6. Remote sensing Models and methods for image processing by Robert A. Schwinger, second edition, 1997, Academic Press

Course Outcomes:

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

1. Explain the concept of remote sensing and various terminologies
2. Summarize the various remote sensing sensors
3. Summarize the various remote sensing platforms
4. Explain the image interpretation technics
5. Explain the digital image processing

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					3				3		3		2	3
CO2	3	3			3	3				3		3	1	2	3
CO3	3	3			2	2			3			2	2	2	3
CO4		3			2	2			3			3	2	2	3
CO5		2			3				2			2	2	2	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2221	Advanced Structural Analysis	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Structural analysis**						

Course Description:

- *The prerequisite for this course would be Mechanics of Solids and Structural Analysis. The effects produced in arches, cables, suspension bridges and frames due to various loads are discussed. The student will be able to analyze statically determinate beams subjected to moving loads. Plastic analysis gives an insight into the structural behavior up to collapse. This course is a pre-requisite for Advanced Design of Steel Structures.*

Course Educational Objectives:

- To analyze three hinged and two hinged arches subjected to various loads.
- To analyze portal frames using moment distribution and Kain's method.
- To construct influence line diagrams for determinate structures.
- To assess the maximum shear force and bending moment in determinate structures under rolling loads.
- To analyze cables and suspension bridges and to determine the collapse loads using plastic analysis.

UNIT 1 Arches 8 hours

Three hinged Arch:
Introduction, Analysis of three hinged arch, B.M, S.F and normal thrust in three-hinged arches, Three hinged parabolic arch subjected to concentrated loads and uniformly distributed loads
Two hinged Arch:
Introduction, Analysis of two hinged arch, B.M, S.F and normal thrust in two-hinged arches, Two hinged parabolic arch subjected to concentrated loads and uniformly distributed loads

UNIT 2 Analysis of statically indeterminate frames 10 hours

Moment distribution method: Analysis of single-story, single bay portal frames under gravity and lateral loads.
Kani's method: Analysis of single-storey, single bay portal frames under gravity and lateral load

UNIT 3 Influence lines and Rolling Loads 8 hours

Introduction, Influence lines for reactions, shear force, and B.M for statically determinate beams, S.F and B.M at a point due to rolling loads(point loads and udl) in statically determinate beams, Absolute maximum B.M, Absolute maximum S.F in statically determinate beams.

UNIT 4 Cables and Suspension Bridges 10 hours

Introduction, Analysis of Cables Under Concentrated Loads and Uniformly distributed Loads, Shape of Cable under Self-Weight, Stresses in suspended Wires due to Self-Weight, Anchorage of Suspension Cables, Stiffened Bridges, Bending moment and shear force for Three Hinged Stiffened Girders, Influence Lines for B.M and S.F in Three-Hinged Stiffening Girders, Suspension Bridges with Two-hinged Stiffening Girders.

UNIT 5 Plastic Analysis 8 hours

Introduction, Shape factor, Plastic Hinge, Collapse Mechanisms, Static and Kinetic Theorems, Methods of analysis, Fixed and Continuous Beams.

Text Books:

1. **1.**Vazirani and Ratwani, Analysis of Structures, Vol-II, 16/e, Khanna Publishers, 2015
2. G.S. Pandit, S.P. Gupta, R. Gupta, Theory of Structures-Vol II, 2/e, Tata McGraw-Hill,2003.

References:

1. C.K. Wang, Statically Indeterminate Structures, Tata McGraw Hill, 2010.

2. J.S. Kinney, Indeterminate Structural Analysis, 1/e, Naroja Publishing, 1987.

3. Weaver and Gere, Matrix Methods of Framed Structures,2/e, CBS publisher, 1990.

4. Thandavamurthy, Structural Analysis, 2/e, Oxford University Press, 2011.

Course Outcomes:

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

1. determine shear force, bending moment and normal thrust in three hinged and two hinged arches (L5).
2. construct BM diagram for portal frames (L6).
3. demonstrate influence lines for determinate structures (L2).
4. determine the forces in cables and suspension bridges (L5).
5. evaluate the shape factor and collapse loads (L5).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3							2		1		
CO2	2	2	2	3							2		2		
CO3	2	2	2	3							2			2	
CO4	2	2	2	3		3					2			2	
CO5	2	2	2	3		3					2		1		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2231	PRECAST CONCRETE	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

- To differentiate between Precast and other forms of construction.
- To bring about an understanding of the prefabrication and construction techniques adopted.
- To understand the Pre-casting and handling techniques.
- To study various ingredients for Precast Concrete.
- To select the relevant precast concrete element for a given type of construction.

UNIT 1 Introduction 8 hours

Description of Precast Concrete Construction. Difference between Precast and Other forms of Concrete construction. Advantages of this form of construction.

Applications

Pre-cast and pre-fabricating technology for low cost and mass housing schemes. Small pre-cast products like door frames, shutters, Ferro-cement in housing - Water tank service core unit.

UNIT 2 Ingredients for Precast Concrete 8 hours

Concrete, Steel Reinforcement, Structural Steel and Bolts, Non-cementitious materials.

UNIT 3 Techniques of Pre-casting 8 hours

Pre-casting techniques - Planning, analysis and design considerations - Handling techniques - Transportation Storage and erection of structures.

UNIT 4 Joint in Structural Members 8 hours

Joints for different structural connections – Dimensions and detailing – Design of expansion Joints

UNIT 5 Design for Abnormal Loads 8 hours

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

Text Books:

1 Levitt. M., Precast concrete - Materials, Manufacture Properties and Usage, Applied Science Publs. 1982,

2 Precast Concrete Structures- Elliot Kim

3. IS 15916 Building Design And Erection Using Prefabricated Concrete — Code Of Practice

Course Outcomes:

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

- Demonstrate the precast concrete concepts, types of precast construction and its advantages.
- Illustrate prefabrication construction.
- Summarize the material specifications for precast concrete.
- Examine different types of pre-cast elements.
- Explain the design for abnormal loads.

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 0	PO 10	PO 11	PS1 2	PS O1	PS O2	PSO 3
CO 1	1	1	1	0	1	2	2	0	0	0	0	1	1	1	2
CO 2	1	2	1	0	1	2	1	0	0	0	0	1	1	2	2
CO 3	2	3	2	1	1	2	1	3	0	0	1	1	2	2	3
CO 4	2	2	2	1	1	2	0	3	0	0	1	1	2	2	3
CO 5	2	2	2	2	2	1	0	3	1	0	1	1	2	2	3

APPROVED IN:

BOS : 04-07-2022 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2241	ROCK MECHANICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**Geotechnical Engineering**						
Co-requisite	None						
Preferable exposure	**Engineering Geology**						

Course Description:

This course mainly provides an understanding of the engineering properties of rocks, geological and engineering rock classifications, rock failure theories, in-situ stresses in rock, and the fundamental concepts and principles of rock mechanics. This will help to understand the design aspects of various structures in/on rock like tunnels and other underground openings, slopes etc. The course also covers the in-situ tests on rocks through various methods to test the suitability of rock at foundation level. It also covers the methods to improve the properties of rock mass by reinforcing, grouting and with supports.

Course Educational Objectives:

- To familiarize the concepts of structural geology of rocks and the classification of rock masses
- To demonstrate the testing of rock samples in the laboratory
- To acquaint the Rock Quality Designation and its necessity
- To study the in situ strength of the rocks
- To expose how to improve the properties of rock masses

UNIT 1 **8 hours**

Physical and structural geology, faults and shear zones - treatment -engineering classification -need -classification of intact rock and in situ rock masses -in situ state of stress mapping of joints.

UNIT 2 **Laboratory Testing** **8 hours**

Rock sampling – Determination of density, Porosity and Water absorption – Uniaxial Compressive strength – Tensile strength – Shear Strength – Flexural strength – Swelling and slake durability – permeability – point load strength – Dynamic methods of testing – Factors affecting strength of rocks, Deformation and failure of rocks.

UNIT 3 Rock Mass Classification 8 hours

Classification by Rock Quality Designation, Rock structure Rating, Geomechanics and NGI classification systems. Applications.

UNIT 4 In situ testing 9 hours

Necessity and Requirements of in – situ tests – Types of in – situ tests – Flat jack Technique – Hydraulic Fracturing Technique, In-situ Permeability test, Pressure Tunnel Test, Plate Load Test, Shear Strength Test, Radial Jack Test, Goodman Jack Test and Dilatometer Test.

UNIT 5 Methods of Improving Rock Mass properties 9 hours

Rock Reinforcement – Rock bolting – Mechanism of Rock bolting – Principles of design – Types of rock bolts, Cable anchorage. Pressure grouting – grout curtains and consolidation grouting, Shot creating.

Text Books:

1. Goodman, R.E. “Introduction to Rock Mechanics” John Wiley & Sons, New York, 2010.
2. John A.Franklin and Maurice B. Dusseault “Rock Engineering Applications” Mc Graw Hill, Inc. 1991.

References:

1. Kiyoo Mogi “Experimental Rock Mechanics” Taylor& Francis Group, UK, 2007.
2. Jaeger, J.C., Cook, N.G. and Zimmerman, R.W. “Fundamentals of Rock Mechanics” Blackwell pub.,2012.

NPTEL Links

Module 1: https://nptel.ac.in/courses/105106055/
https://nptel.ac.in/courses/105106055/2
Module 2: https://nptel.ac.in/courses/105106055/6
https://nptel.ac.in/courses/105106055/7
Module 3: https://nptel.ac.in/courses/105106055/11
https://nptel.ac.in/courses/105106055/12
Module 4: https://nptel.ac.in/courses/105106055/6
https://nptel.ac.in/courses/105106055/7
Module 5: https://nptel.ac.in/courses/105106055/34
https://nptel.ac.in/courses/105106055/35

Course Outcomes:

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

1. Explain the concepts of structural geology and classification of rock masses – L2
2. take part in the laboratory and field testing for a given project / construction – L4
3. classify the rocks based on Rock Quality Designation – L2
4. choose appropriate methods to improve the stability of rock mass – L3
5. estimate the foundation capacity in rock mass- L3

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												2	1	
CO2			2	1	1								1		1
CO3	2												2		
CO4	1		1										1	2	2
CO5		2	1										1		1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2251	PAVEMENT ANALYSIS AND DESIGN	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	CIVL2101- Highway Engineering						
Co-requisite	None						
Preferable exposure	None						

Course Description

The course aims to make the students learn the principles of highways, their components and design of flexible and rigid pavements. The course also focusses different types of stresses that are developed in the pavement structures. Further, students will get acquainted with treatment for failures and remedial measures during maintenance of pavements

Course Educational Objectives:

- Demonstrate factors affecting pavement design
- Impart knowledge on stress solutions for One, Two- and Three-Layered Systems in flexible pavements
- Familiarize stresses and deflections in rigid pavements due to loading and temperature
- Enable design of flexible pavements
- Explain design of rigid pavements.

UNIT 1 Factors Affecting Pavement Design 10 hours

Variables Considered in Pavement Design, Types of Pavements, Functions of Individual Layers, Classification of Axle Types of Rigid Chassis and Articulated Commercial Vehicles, Legal Axle and Gross Weights on Single and Multiple Units, Tire Pressure, Contact Pressure, EAL and ESWL Concepts, Traffic Analysis: ADT, AADT, Truck Factor, Growth Factor, Lane Distributions & Vehicle Damage Factors.

UNIT 2 Stresses In flexible Pavement 8 hours

Visco-Elastic Theory and Assumptions, Layered Systems Concepts, Stress Solutions for One, Two- and Three-Layered Systems, Fundamental Design Concepts

UNIT 3 Stresses in Rigid Pavements 8 hours

Westergaard's Theory and Assumptions, Stresses due to Curling, Stresses and Deflections due to Loading, Frictional Stresses, and Stresses in Dowel Bars & Tie Bars

UNIT 4 Design of Flexible Pavements 8 hours

Factors effecting Design. Deflection studies in Flexible Pavements. Present Serviceability Index. IRC guidelines for Flexible Pavements. Pavement Performance and methods- AASHTO and Asphalt Institute Method. Need for Overlays, Overlays design methods.

UNIT 5 Design of Rigid Pavements 8 hours

Factors effecting Design - Wheel load & its repetition, subgrade strength & proportion, strength of concrete - modulus of elasticity. Reinforcement in slab. Design of joints. Design of Dowel bars. Design of Tie bars. IRC and AASHTO methods of Rigid Pavement design.

Text Books:

1. Yoder, E.J., and Witczak, `Principles of Pavement Design', 2/e. John Wiley and Sons, 1975
2. Khanna S.K., Justo C.E.G., Veeraragavan A., Highway Engineering, 9/e, Nemchand and Bros, Roorkee, 2017

References:

1. Haas and Hudson, Pavement Management System, McGraw Hill Book Co., New York, 1978
2. IRC: 37-2012, Guidelines for the Design of Flexible Pavements.
3. IRC: 58-2015, Guidelines for the Design of Rigid Pavements.

Course Outcomes:

After completion of the course the student will be able to
1. list various factors affecting design **[L1]**
2. identify stresses in flexible pavements in One, Two- and Three-Layered Systems**[L3]**
3. summarize the stresses due to loading and temperature in rigid pavements **[L2]**
4. explain design of flexible pavements. **[L2]**
5. demonstrate design of rigid pavements.**[L2]**

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												2	2	3
CO2	2	3		2	3	1							2	2	3
CO3	2	3	3	2	3								2	2	3
CO4	2	3	3	2	3								2	2	3
CO5	2	3	3	2	3								2	2	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2261	OPEN CHANNEL HYDRAULICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**CIVL2021 - Fluid Mechanics**						

Course Description:

The prerequisite for this course would be fluid mechanics. This course helps the learner to acquire the comprehensive knowledge of open channel hydraulics. This course provides the concepts of hydraulically efficient channel sections of uniform flow. The learner will gain the knowledge and able to apply the principles of specific energy and critical depth. The learner will understand the over view of gradually varied flow and rapidly varied flow of hydraulic jump and flood routing through channel.

Course Educational Objectives:

- to explain types of flows, velocity distribution in open channels
- to teach the significance of specific energy, specific force, section factor, and channel transitions.
- to compute hydraulically efficient channel sections, to outline the features of GVF profiles.
- to impart the significance of hydraulic jump in energy dissipation.
- to explain the flood routing through reservoir and channel.

UNIT 1 **9hours**

Introduction, types of channels, classification of flows, velocity distribution, pressure distribution, specific energy, critical depth – calculation, section factor, channel transitions.

UNIT 2 **Uniform Flow** **9 hours**

Chezy's equation, Manning's formula, velocity distribution, uniform flow computations, hydraulically efficient channel sections, Specific Energy, Specific Force, Critical Flow, Compound channel section, Irrigation canal.

UNIT 3 **Gradually Varied Flow (GVF)** **8 hours**

Differential equation for GVF, classification and features of flow profiles, control sections, simple numerical solutions of GVF problems.

UNIT 4 **Rapidly Varied Flow** **8 hours**

Hydraulic jump in horizontal rectangular, use of jump as energy dissipator, location of jump, ogee spillway, sharp crested weir, broad crested weir, sluice gate flows.

UNIT 5 **8 hours**

Flood Routing through reservoirs and flood routing through channel, Muskingum method of flood routing.

Text Books:

1. **1.** K. Subramanya, Flow in Open Channels, 5/e, Tata McGraw Hill, 2015.
2. VenTe Chow, Open-Channel Hydraulics, McGraw-Hill, 2009.

References:

1. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics and Hydraulic Machines, 20/e, Standard Book House, 2015.
2. A.K. Jain, Fluid Mechanics, 12/e, Khanna publishers, 2014

Course Outcomes:

On successful completion of the course, the student will be able to

1. Classify types of channels, flows, GVF profiles (L-2).
2. Solve problems related to uniform flow in open channels, hydraulically efficient sections, GVF, hydraulic jump (L-3).
3. Familiarize specific energy, Critical energy, section factor, GVF, RVF, surges.
4. Explain the use of channel transitions, compound channels, irrigation canals, flow characteristics of spillway, weir, sluice gate, flood routing through reservoirs and channels (L-2).
5. Derive GVF differential equation (L-4).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	2		1	2	3	2		2	3	1	
CO2	3	3	1	1	2		1	2	3	2		2	3	1	
CO3	3	3	1	1	2		1	2	3	2		2	3	1	
CO4	3	3	1	1	2		1	2	3	2		2	3	1	
CO5	3	3	1	1	2		1	2	3	2		2	3	1	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2271	POLLUTION PREVENTION AND ANAGEMENT	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:
Clean drinking water, hygiene, and sanitation play an important part in maintaining health. Because the health of patients is ***important*** *to hospitals, they are tasked with proper* ***disposal*** *of* ***biomedical waste****. It transports the* ***waste*** *to its treatment facility and then properly treats the* ***waste*** *prior to disposing of it. Bioremediation is a waste management technique that involves the use of organisms to remove or neutralize pollutants from a contaminated site and saves natural resources. Recycling recovers valuable materials from old electronics that can be used to make new products. Globally, 50 million tons of e-waste is generated annually and has all 'potential' to grow at much faster rate than any other waste streams. It is very interesting to note that even after the due use, this particular 'waste' is of great significance & value.*

Course Educational Objectives:
- to introduce about waste disposal methods in rural sanitation
- to study the concepts of biomedical waste management
- to impart about hazardous waste management
- to acquaint with e-waste management rules
- to expose to various bioremediation techniques

UNIT 1 Rural Sanitation 8 hours
Introduction to rural sanitation- Community and sanitary latrines - Planning of wastewater collection system in rural areas- Treatment and Disposal of wastewater - Compact and simple wastewater treatment units and systems in rural areas- stabilization ponds - septic tanks - Imhoff tank- soak pits- low cost excreta disposal systems- Effluent disposal.

UNIT 2 Biomedical Waste Management 8 hours
Definition-Sources-Classification of biomedical waste – Objectives of Biomedical waste management-segregation-containers for biomedical waste-Labeling Collection-Transport-Disposal methods.

UNIT 3 Industrial and Hazardous Waste Management 8 hours
Industrial waste types, characteristics of industrial wastes, pollution from major industries, effects of industrial effluents, cleaner production, treatment technologies; Hazardous wastes definition, sources of hazardous waste, transportation, treatment and disposal methods and processes

UNIT 4 E-Waste management 8 hours

E-waste : Sources- Types- components; Collection process- Segregation-Disposal methods; Effect on air, water and soil; Health hazards; Role of individual for E-waste management. Current E-waste Management Rules.

UNIT 5 Bioremediation for soil environment 8 hours

Soil-water-environment interaction, Soil Organic Matter and Characteristics -Biotechnologies for Ex-Situ Remediation of Soil - Biotechnologies for in-Situ Remediation of Soil - Emerging Environmental Biotechnologies- Phytoremediation -Sequestering Carbon Dioxide - Biomonitoring -Application of Microbial Enzymes -Biomembrane Reactors

Text Books:

1. Juuti, P., Tapio S. K., and Vuorinen H., Environmental History of Water: Global Views on Community Water Supply and Sanitation, IWA Publishing (Intl Water Assoc), 2007.
2. Rittmann, B.E., and McCarty, P.L., Environmental Biotechnology: Principles and Applications, McGraw Hill, 2001.

References

1. Reddy, L.N. and Inyang. H. I., Geoenvironmental Engineering –Principles and Applications, Marcel Dekker, Inc., New York., 2000
2. Industrial Wastewater Management, Treatment and Disposal, WEF Manual of practice No. FD-3, 3rd Ed., WEF Press and McGrawHill, 2008

Course Outcomes:

1. summarize the disposal techniques of rural sanitation –L2
2. analyze best disposal techniques in biomedical waste management –L4
3. explain various treatment methods of Industrial And Hazardous Waste –L2
4. estimate the e-waste generated –L5
5. assess the role of microorganism in bioremediation techniques –L4

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 0	PO 10	P O 1 1	PS12	P S O 1	P S O 2	P S O 3
CO1		2		2					2	2			2	2	
CO2	2	2	2	2		2			2				2	2	2
CO3			2	2					2	2			2	2	
CO4		2	2	2	2								2	2	
CO5	2	2	2	2						2			2	2	2

APPROVED IN:

BOS : 04-07-2022

ACADEMIC COUNCIL: 22nd AC (01-04-2022)

SDG No. & Statement:

SDG Justification:

x

CIVL2281	Disaster Management	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co- requisite	None						
Preferable exposure	None						

Course Description:

Most of the hazards turn into disasters due to unsustainable activities of human beings and cannot be completely avoided. However, the impact can be mitigated by proper planning, preparedness and organizing at various levels. Engineers may have to work in varied locations where in they have to encounter a variety of disaster scenarios. Hence, they need to have adequate knowledge to deal with these disasters. This subject is aimed at providing a detailed understanding of various phases of disaster management, vulnerability profile and organizational structure of disaster management in India, and applications of science & technology for better disaster management.

Course Educational Objectives:

- Fundamental definitions related to disaster management, classification of disasters.
- The disaster management cycle, Disaster Risk Reduction (DRR) and community based DRR.
- Impacts of development projects on disasters, climate change adaption, usage of indigenous knowledge in DRR.
- Features and provisions of the Disaster Management Act 2005.
- Study and project report preparation of case study of a disaster

UNIT 1 8 hours

Introduction to Disasters: Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity, Resilience. Classification and types of disasters, Natural disasters and Man-made disasters, Causes of Disasters and Impacts (social, economic, political, environmental etc). Vulnerability profile of India, Differential impacts in terms of class, gender, age, location, disability. Global trends in disasters, Urban disasters, Pandemics, complex emergencies

8 hours

UNIT 2

Approaches to Disaster Risk Reduction: Phases and activities of disaster management cycle, Prevention, Mitigation and Preparedness, Community based disaster risk reduction, Structural and Non-structural measures, roles and responsibilities of community, Panchayat Raj Institutions / Urban Local Bodies, States, Centre.

UNIT 3 8 hours

Inter-Relationship between Disasters and Development: Factors affecting vulnerabilities, Impacts of development projects such as dams, change in land use etc. Climate change and its adaptation, relevance of indigenous knowledge, appropriate technologies.

UNIT 4 8 hours

Components of Disaster Relief: Water, food, shelter, health, sanitation, waste management, Institutional arrangement, Disaster Management in India, National Disaster Management Authority (NDMA), Disaster Management Act 2005, Disaster Management Plan.

UNIT 5 8 hours

Project work (Case Studies of Disaster Management): The project/Student presentations for understanding the causes, effects and remedial measures in mitigating the disaster risks and to build the culture of safety. Projects shall be conceived creatively base on the geographic location and hazard profile of the region where the college/institute is located. A few ideas or suggestions to be discussed.

TextBooks:

1. G.K. Ghosh, Disaster Management, A.P.H. Publishing Corporation, 2011.
2. Mukesh Kapoor, Disaster Management, Dhanpat Rai, 2012.

References:

1. A.K. Jain, A Practical Guide to Disaster Management, 2013
2. H.K. Gupta., Disaster Management, 2013
3. Patrick L. Abbott., Natural Disasters, McGraw-Hill Higher Education, 2014
4. Nikuj Kumar, Disaster Management, Alfa Publications, 2012
5. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
6. http://www.unisdr.org/ • http://www.ndma.gov.in/en/ • http://nidm.gov.in/default.asp • https://www.ifrc.org/

Course Outcomes:

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

1. Concepts and definitions of disaster management, classification of disasters
2. Phases of disaster management cycle, community based Disaster Risk Reduction.
3. Impact of development projects on disasters, adaptability to climate change, usage of indigenous knowledge in disaster management.
4. Institutional arrangements, Disaster Management Act, related policies, programs.

5. Case study of a disaster and prepare a report on the same.

CO-PO Mapping:

4 year UG program:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3				2	2		1			1			
CO2	3	3	2	2		2	2		1			1	2	1	
CO3	3	3	2	2		2	2		1			1	2	1	
CO4	3	3	2	2		2	2		1			1	2	1	
CO5	3	3	2	2		2	2		1			1	2	1	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:	
BOS : 13-01-2023	**ACADEMIC COUNCIL: 16-05-2023**
SDG No. & Statement:	
SDG Justification:	

CIVL2291	Sustainable Management of Water and Environment	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course examines ways to value, manage and sustain water systems for agriculture, industry, the built environment, recreation and ecosystems. Topics include principles of water resource Modelling and integrated resource management, water accounting in time and space, supply and demand management, and pros and cons with decentralized and centralized solutions.

UNIT 1 **8 hours**

Water resources, Global water budget, Indian rivers, quantity of water, rainfall, floods and its measurement.

UNIT 2 **8 hours**

Major reservoirs in India, benefits of water storage reservoirs, Groundwater, aquifers, yield of wells.

UNIT 3 **8 hours**

Sustainable management of water, methods of rainwater harvesting, recycling of water

UNIT 4 **8 hours**

Solid-waste, types of waste, collection of solid-waste, disposal of solid-waste.

UNIT 5 **8 hours**

Case studies of sustainable management of water and solid-waste.

Text Books:

1. Jaya Rami Reddy P, Text book of Hydrology, Laxmi Publications, 2016
2. Surendra Kumar, Solid waste management, Northern Book Center, 2009

References:

1. Daniel H. Chen, Sustainable Water Management, CRC Press, 2018
2. Rao K.L., India's Water Wealth, Orient BlackSwan
3. Sashikumar P, Solid waste management, Prentice Hall of India, 2009

Course Outcomes:

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

1. demonstrate critical thinking about sustainable water systems
2. engage with major policy issues and concepts including water regulation, governance, and the water-energy-food nexus.
3. discuss theoretical and substantive areas of water management for different human and natural uses.
4. articulate methods used in evaluating sustainable water systems such as Modelling, demand and supply management and water accounting.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3				2	2		1			1			
CO2	3	3	2	2		2	2		1			1	2	1	
CO3	3	3	2	2		2	2		1			1	2	1	
CO4	3	3	2	2		2	2		1			1	2	1	
CO5	3	3	2	2		2	2		1			1	2	1	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3031	Advanced Reinforced Concrete Structures	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	Design of Reinforced Concrete Structures						
Co-requisite	Nil						
Preferable exposure	IS456						

Course Description:

This is an advanced course useful for the student to enable them the design of advanced RCC structures. The student will be able to design RCC staircases, retaining walls, and water tanks. The course also includes the design of slab bridges and flat slabs.

Prerequisite: Mechanics of Solids, Structural Analysis and Design of Reinforced Concrete Structures.

Course Educational Objectives:

- To enable the design of staircases.
- To demonstrate the design of retaining walls.
- To familiarize the design methodology of flat slabs.
- To enable the design of water tanks resting on ground.
- To train on the design of simple bridge deck slab.

UNIT 1 Design of Staircases 8 hours

Introduction, Principles of Design, Applied Loads, Design of Stairs Spanning Transversely(Horizontally) and Stairs spanning Longitudinally.

UNIT 2 Retaining Walls 8 hours

Types of retaining walls, forces on retaining walls, stability requirements, Preliminary proportioning of cantilever/counterfort retaining walls, Design of cantilever and counterfort retaining walls.

UNIT 3 Design of Flat Slabs 8 hours

Direct Design Method – Distribution of Moments in column strips and middle strip – moment and shear transfer from slabs to columns – shear in flat slabs – check for one way shear – Introduction to equivalent frame method. Limitation of direct design method – Distribution of moments in column strips and middle strip

UNIT 4 Design of Water tanks 8 hours

Introduction, Design Requirement, Methods of Analysis, Design of Circular tanks resting on ground, Rectangular tanks resting on ground.

UNIT 5 Design of slab bridge 10 hours

Design loads for bridges: Introduction, load distribution theories, Design loads- Dead load, Vehicle Live Load, Impact Effect, Wind Loading, Longitudinal forces.

Slab bridges: Introduction, Wheel load on slabs, Effective Width Method-Slab supported on Two Edges (Simply Supported Slabs), Dispersion length, Design of slab bridges.

Text Books:

1. P.C.Varghese, Advanced Reinforced Concrete Design, 2/e, Prentice Hall of India, 2010.
2. S.S.Bhavikatti, Advance R.C.C Design(R.C.C. Volume- II),2/e, New Age International Publishers, 2012.

References:

1. Pillai and Menon, Reinforced Concrete Design, 3/e, Tata McGraw Hill, 2017.
2. T.R.Jagadeesh and M.A.Jayaram, Design of Bridge Structures, 2/e, Prentice Hall of India, 2014.
3. P.C.Varghese, Limit State Design of Reinforced Concrete, 2/e,Prentice Hall of India, 2015.

Course Outcomes:

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

1. design a staircase (L6)
2. design a cantilever and counterfort retaining walls (L6).
3. analyze and design flat Slabs (L4).
4. design water tanks resting on ground (L6).
5. design a bridge deck slab (L6).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	1		3	1		1	2	3	3	3
CO2	3	3	2	2	1	1		3	1		1	2	3	3	3
CO3	3	3	2	2	1	1		3	1		1	2	3	3	3
CO4	3	3	2	2	1	1		3	1		1	2	3	3	3
CO5	3	3	2	2	1	1		3	1		1	2	3	3	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3041	ANALYSIS & DESIGN OF STRUCTURAL ELEMENTS USING SOFTWARE	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

- To familiarize with modelling tools in ETABS software.
- To apply ETABS software for design of beams with different boundary conditions.
- To perform Response Spectrum Analysis using ETABS software
- To apply STAAD Pro software for analysis and design of beams and columns
- To apply STAAD Pro software for analysis and design of footings.

UNIT 1 **8 hours**

Introduction. Various software used for analysis and design of structures, Modeling Features, Analysis Features, Design Features, Detailing Features.

UNIT 2 **8 hours**

ETABS Modeling – Tools to create Geometry, Defining Properties, Material Properties, Section Properties, Load Patterns, Mass source, Load Cases, Load Combinations, Checking the model for any errors and eliminating if any.Analysis and design of different types beams for a given boundary conditions.

UNIT 3 **8 hours**

ETABS Analysis Techniques Linear Static Analysis, P-Delta Analysis, Response Spectrum Analysis for different soil conditions and given seismic zone.

UNIT 4 **8 hours**

Design of structural elements using STAAD Pro software. Analysis and Design of beam and column (Steel/RCC)

UNIT 5 **8 hours**

Design of foundation units using STAAD Pro software

Analysis and design of isolated and combined footing (rectangular)

List of Laboratory experiments

1) Analysis and design of different types beams of given boundary conditions using ETABS
2) Response Spectrum Analysis for different soil condition and given seismic zone using ETABS
3) Analysis and Design of steel beam using STAAD Pro
4) Analysis and Design of steel column using STAAD Pro
5) Analysis and design of isolated footing (rectangular) using STAAD Pro
6) Analysis and design of combined footing (rectangular) using STAAD Pro

Text Books:

Course Outcomes:

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

- To prepare input data for analysis and design in ETABS.
- Analyze and design beams with different boundary conditions using ETABS.
- Perform Response Spectrum analysis using ETABS
- Analysis and Design of beam and column using STAAD Pro
- Analysis and Design of isolated and combined footings using STAAD Pro

CO-PO Mapping:															
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 0	PO 10	PO 11	PS1 2	PS O1	PS O2	PS O 3
CO1	1	1	1	0	3	2	0	0	1	0	0	1	2	1	0
CO2	1	1	1	0	3	2	0	0	1	0	0	1	2	1	0
CO3	2	2	2	2	3	2	0	0	2	0	1	1	2	2	0
CO4	2	2	2	2	3	2	0	0	2	0	1	1	2	2	1
CO5	2	2	2	2	3	2	0	0	2	0	1	1	2	2	1

APPROVED IN:

BOS : 04-07-2022 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3051	Advanced Foundation Engineering	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	Geotechnical Engineering & Foundation Engineering						
Co-requisite	Nil						
Preferable exposure	Nil						

Course Description:

This course describes the principles of design of shallow foundation and settlement analysis. It also covers designing of footings for different soil conditions. Basic principles of determination of bearing capacity and design of pile foundations using various methods are also covered in this course. Foundations on highly problematic soils like expansive soils and its design practices are also discussed.

Course Educational Objectives:

- To familiarize the fundamental concepts of foundation analysis and design.
- To acquaint the analysis of bearing capacity and settlement of foundations using different methods
- To enable the proportionating of different types of footings and develop beams on elastic foundations
- To study the determination of the load carrying capacity and settlement of pile foundations and under reamed piles.
- To train the identification of expansive soils and practice foundations on expansive soils.

UNIT 1 Introduction 7 hours

Principles of Design of Foundations, Types of shear failures in foundation soils, Types of foundations, Design Loads, Basic Concepts of safe and allowable bearing capacity. Shallow Foundations

UNIT 2 Bearing Capacity Analysis and Settlement Analysis 9 hours

Bearing Capacity Analysis: Bearing capacity theories – Terzaghi, Meyerhof, Skempton, Hansen, Vesic and IS Methods, Bearing capacity evaluation from Standard Penetration test and Plate load test.

Settlement Analysis: Uniform and Differential Settlements, Elastic and Consolidation Settlements, Penetration tests; Permissible settlements as per IS 1904-1978, causes of settlement, settlement Control.

UNIT 3 Proportioning of footings 9 hours

Isolated column footings, Strip, combined Footings and Strap Footing. Raft Foundations: Bearing capacity of raft foundation, floating raft, Types of rafts, Beam on Elastic foundation and Conventional methods of Design, determination of modulus of subgrade reaction.

UNIT 4 Deep Foundations and Well Foundations 9 hours

Deep Foundations: Pile Foundations: Types, load capacity- dynamic formulae, static formula; pile load tests- Vertical load test, lateral load test, Cyclic load test; settlement of piles and pile groups, negative skin friction on single pile and pile groups;
Well Foundations: Types, Bearing Capacity of well foundations, Tilts and Shifts: precautions, Remedial measures

UNIT 5 Foundations in Expansive Soils 8 hours

Introduction, Identification of expansive soils, Swell potential and swelling pressure, Active depth, Foundation Problems, Foundation practices in expansive soils, Soil Replacement and 'CNS' concepts.

Text Books:

1. Foundation Analysis and Design by J.E. Bowles, Mc Graw Hill Publishing Co, 2001.
2. Foundation Design by W.C. Teng, John Wiley, New York, 1962.

References:

1. Analysis and Design of Substructures by Swami Saran, Oxford &IBH Publishing Co, 2006.
2. Foundation Engineering by P.C. Vargheese, Prentice Hall of India, 2005.

NPTEL LINKS

1. Shallow foundations http://nptel.ac.in/courses/105107120/
2. Pile foundations http://nptel.ac.in/courses/105107120/13

Course Outcomes:

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

1. outline the design philosophy of foundation engineering – L2
2. interpret field and laboratory data to get design parameters for foundation analysis – L2
3. design the piles for various types of loadings– L4
4. identify the typical failure modes of common foundations - L3
5. solve foundation problems with the given procedures and the soil properties, and understand their limitations – L3

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2		3	2	1		3			2	2	2	2
CO2	3	3	2		2	2	1		1			2	2	2	2
CO3	3	3	2		2	2	1		1			2	2	2	2
CO4	3	3	2		3	2	2		3			2	2	2	2
CO5	2	3	2		1	1	2		1			2	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3061	AIR POLLUTION & ITS CONTROL	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Air pollution is a major contributor to global warming and climate change. In fact, the abundance of carbon dioxide in the air is one of the causes of the greenhouse effect. But the excessive concentration of these gases in the atmosphere is the cause of the recent climate change. The meteorological parameter plays a key role in control of air pollution. Thus this course imparts knowledge on the basic causes of air pollution and their control of indoor/particulate/gaseous air pollutant and its emerging trends

Course Educational Objectives:

- to study various air pollutants and to compare various air quality standards.
- to introduce the mechanism of various plume behaviors.
- to study various effects of air pollutant and to recollect various case histories
- to familiarize with various methods of controlling air pollution
- to impart the basics of noise pollution and its control and prevention methods

UNIT 1 Basic Introduction 8 hours

Air Pollution and its definition, Factors influencing air pollution, Sources and Classification of air pollutants –natural and manmade, primary and secondary air pollutants. National & International air emission standards.

UNIT 2 Meteorology 8 hours

Importance of meteorological parameters, stability conditions, types of inversions lapse rate, mixing depth, mixing height, atmospheric dispersion, plume behaviour -effective stack height Gaussian plume models.
Learning Outcomes:

UNIT 3 Effects and sampling procedures 8 hours

Effect of air pollution on humans, plants and materials. Basic Principles of Sampling, Source and Ambient Sampling, Analysis of air Pollutants. Air pollution episodes (India & Abroad)

UNIT 4 Noise pollution 8 hours

Sources of Noise Pollution, Effects, Assessment procedures, Standards of noise pollution, Control Methods and Prevention.

UNIT 5 Air Pollution Control 8 hours

Selection Criteria for Equipment, Principles of Control Measures, Particulates Control by Gravitational, Centrifugal, Filtration, Scrubbing, Electrostatic Precipitation, Gaseous Pollutant Control by Adsorption, Absorption, Condensation, Combustion.

Text Books:

1. M.N. Rao and H.V.N. Rao, Air Pollution, Tata McGraw, 2017.
2. C.S. Rao, Environmental Pollution Control, 2/e, Wiley Eastern, 2006.

References:

1. Colls, J., Air Pollution: Measurement, Modelling and Mitigation, CRC Press, 2009
2. Heumann. W.L., “Industrial Air Pollution Control Systems”, McGraw Hill, New Yark, 2007.
3. Anjaneyulu, D., “Air Pollution And Control Technologies”, Allied Publishers, Mumbai, 2002
4. https://nptel.ac.in/courses/105102089/8

Course Outcomes:

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

1. classify various types of air pollutants –L2
2. explain the mechanism of plume behaviour -L2
3. summarize the effects of air pollution on humans, plants and materials–L4
4. paraphrase various controlling methods of air pollutions-L5
5. evaluate various sources of noise pollution and their preventive methods-L5

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1												2		
CO2	2												2		
CO3	1												2		
CO4	3												3		
CO5	2												2		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3071	CONSTRUCTION MANAGEMENT	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course Construction Management focuses planning, scheduling and monitoring of construction projects. Complex research and development projects can be managed effectively if the project managers have the means to plan and control the schedules and costs of the work required to achieve their technical performance objectives. To present the basic principles of PERT and CPM in a such a way that they can be effectively applied to the solution of management problems.

Course Educational Objectives:

- To facilitate the basics tools used in construction projects.
- To impart the idea about planning and scheduling of activities.
- To explain about the time cost trade off model.
- To demonstrate about principals of Construction Management.
- To familiarize the Policy and Rules of the Organization.

UNIT 1 Introduction to Construction Management 8 hours

Origin of PERT and CPM, Planning, Scheduling and controlling,Barcharts, Milestone charts, weaknesses in Barcharts, PERT and CPM networks and Problems, Comparison, Event, Activity, Rules fordrawing networks Numbering the events (Fulkerson’s law), Dummy activities, Work Break-down structure.

UNIT 2 CPM-PERT-Network Analysis 8 hours

Time estimate-Expected time, Earliest allowable occurrence time, Latest allowable occurrence time, slack and Problems, Problems on Network Analysis, project duration, probability of completion, Start and Finish time estimates, Floats and Problems, Project scheduling, Critical and sub-critical path.

Updating – Process of updating; when to update

UNIT 3 CPM Cost Model & Resources allocations, resource scheduling 8 hours

Cost Analysis; direct and indirect costs,

operation time, Normal and crash times and costs, Problems on cost analysis, Optimising project cost, crash limit, Free float limit, Optimization Resource smoothening. Resource levelling.

UNIT 4 Management 8 hours

Scope of Construction Management; Significance of Construction Management, Concept of Scientific Management; Safety in Construction, Qualities of Manager; The roles/functions performed by effective and competent Managers, The Manager: i) as a decision maker; ii) as a motivator; iii) as a communication-link; iv) as a conflict resolver; v) as a well – wisher of co-employees and the employer; etc

UNIT 5 Organization 8 hours

Types of organization; Merits and demerits of different types of organization – Authority – Policy– Labour Problems; Labour Legislation in India; ‘Workmen’s compensation Act of 1923 and Minimum Wages Actof 1948’, and subsequent amendments

Text Books:

1. Dr. B. C. Punmia and K. K. Khandelwal, Project Planning and Control with PERT and CPM, 4/e, Laxmi Publications, 2016.
2. Kumar NeerajJha, Construction Project Management: Theory and Practices, 2/e, Pearson Education, 2015

References

1. Dr. P. N. Modi, Rajeev Modi, PERT and CPM - Project Evaluation Review Technique and Critical Path Method, 5/e, Standard Book House, 2012.
2. L. S.Srinath, PERT and CPM Principles and Applications, 3/e, Affiliated East-West Press, 2001.
3. U.K. Shrivastava, Construction Planning and Management, 2/e, Galgotia Publications - New Delhi, 2000.
4. Kerzner H., Project Management- A systems approach to planning, scheduling and controlling, 10/e, John Wiley & Sons, Inc., New Jersey, USA, 2009.
5. NPTEL Web Course- Principles of Construction Management- https://nptel.ac.in/courses/105104161/

Course Outcomes:

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

- choose best method to implement in construction projects.[L-1]
- interpret on various time estimates in construction projects.[L-2]
- identify the optimum time corresponding to optimum cost by cpm cost model analysis.[L-3]
- plan and develop management solutions to construction projects.[L-3]
- summarize the characteristics & policies of the Organization.[L-2]

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 0	PO 10	PO 11	PS1 2	PS O1	PS O2	P S O 3
CO1	2	2											2		
CO2	3	2					2						2		
CO3		3		2									2		
CO4	2	3	2		3									3	2
CO5	2	3		2	3									3	2

APPROVED IN:

BOS : 24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3081	URBAN TRANSPORT PLANNING	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course will offer an introduction to transportation planning, including both theoretical and practical approaches. This course will provide an understanding of the evolution and role of urban public transportation modes, systems and services. This course will include characteristics of different modes (rail, bus, air), scheduling, budgeting, grants, modeling, route design considerations, transit-oriented development, public involvement, and project development.

Course Educational Objectives:

- Familiarize basic concepts and methods of urban transportation planning in the India.
- Explain methods of designing, conducting and administering surveys to provide the data required for transportation planning.
- Impart knowledge on trip generation and trip distribution models
- Demonstrate travel demand modelling, Mode Choice Modelling and Traffic Assignment Modelling.
- Focus on principles of travel demand modelling in solving problems.

UNIT 1 Land use and Transportation System 8 hours

Introduction-Urban system Components-Concepts and definitions-Criteria for measuring urban sprawl— Location theory-urban growth or decline

UNIT 2 Transportation Planning Process 8 hours

Introduction-Definition-Factors to be considered; Land use transportation planning; systems approach-Stages-Inventory of Existing Conditions-Difficulties in implementation.

UNIT 3 Transport Surveys 8 hours

Basic Movements- Study Area-Zones-Surveys- Planning of different types of surveys and interpretation, Travel demand; Traffic surveys for mass transit system planning.

UNIT 4 Trip Generation and Distribution 8 hours

Factors governing trip generation and attraction – Application of Regression Analysis- Methods of trip distribution; Growth and Synthetic Models- Calibration and Application of gravity model- Category analysis. Problems

UNIT 5 Modal Split and Assignment 8 hours

Factors affecting modal split; Modal split in transport planning; Principles of traffic assignment; assignment techniques. Problems

Text Books:

- Kadiyali, L.R., Traffic Engineering and Transport Planning, 9/e, Khanna Publishers, 2018
- Khisty C. J and Lall B. K, Transportation Engineering: An Introduction, 3/e, Prentice Hall India, 2017

References

- Hutchinson, B.G., Principles of Urban Transport System Planning, 1/e,Taylor& Francis Inc, 1987
- NPTEL Web Course on Urban Transportation Planning - https://nptel.ac.in/courses/105107067/

Course Outcomes:

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

- Develop and conduct surveys to provide the data required for transportation planning**[L3]**
- Model zonal demand generation and attraction regression models**[L3]**
- Develop demand distribution models (gravity models) and modal split models for mode choice analysis**[L3]**
- Develop and calibrate trip generation rates for specific types of land use developments**[L3]**
- Solve problems related to modal split om transportation planning **[L3]**

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO0	PO10	PO11	PS12	PSO1	PSO2	PSO3
CO1						3				2	2	2			
CO2	2	3	3	3	3	3			2	2			2	2	2
CO3	2	3	3	3	3	3			2	2					2
CO4		3		3	3				2	2	2		2	2	
CO5	2	3		3	3	3			2	2	2		2	2	2

APPROVED IN:

BOS : 04-07-2022 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

<table>
<tr><td rowspan="2">CIVL2301</td><td rowspan="2">ADVANCED GEOGRAPHIC INFORMATION SYSTEMS</td><td>L</td><td>T</td><td>P</td><td>S</td><td>J</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">CIVL1001-Basics of Geographic Information Systems</td></tr>
<tr><td>Co-requisite</td><td colspan="7">None</td></tr>
<tr><td>Preferable exposure</td><td colspan="7">GIS Software and analysis techniques</td></tr>
</table>

Course Description:

To understand the advanced concepts in GIS like data model, spatial data analysis, data visualization, modelling.

Course Educational Objectives:

- To familiarize with the concept spatial data types and models
- To familiarize with data Sources and data entry
- To familiarize with GIS data processing
- To understand spatial data analysis and data visualization
- To understand advanced spatial data analysis and modeling

UNIT 1 Spatial Data Types and Models 8 hours

Spatial Data types, non-spatial data types, Tessellations to represent geographic objects, Data models: Basic Data Models –raster and vector, Spaghetti model and Topological model.

UNIT 2 Data Sources and Data Entry 8 hours

Primary and secondary methods of acquisition of spatial and non-spatial data, Database creation, Data capturing, map scanning and digitizing, data exchange standards, topology building, editing, and cleaning, linking of spatial and non-spatial data.

UNIT 3 Data Processing 8 hours

Hardware and software needed, Linking GIS and DBMS, Raster and Vector data editing, data conversion, Corrections, scale changes, Coordinate thinning, Georeferencing and map projections, sliver removal, edge matching, interactive editing, rubber sheeting.

UNIT 4 Spatial Data Analysis and Integration and Data Visualization 8 hours

Spatial Data Analysis and Integration: Vector Data Analysis, Raster Data Analysis, Network Analysis, Terrain analysis, spatial analysis of 3-Dimensional data, Data integration and map overlay.

Data Visualization: GIS and Maps, Visualization process, mapping qualitative and quantitative data, map / information dissemination.

UNIT 5 Advanced Spatial Data Analysis and Modelling 8 hours

Trend surface analysis, Spatial interpolation, fuzzy analysis, GIS analytical models: Digital Terrain Models, Hydrologic modelling, Spatial Multi Criteria Analysis.

Demonstration:

1. Familiarization with Maps of different scales (SOI Toposheets)
2. Familiarization with Monochromatic and Multispectral Satellite Imagery (Creation of FCC) Downloading Satellite Images
3. Geometric Correction of Satellite Data (Georeferencing, Mosaicking and Subletting) Atmospheric & Radiometric Correction of Satellite Images
4. Feature extraction (Vectorization) using GIS Software-Map Composition

Text Books:

1. GIS and Multi-criteria decision analysis by Jacek Malczewski, John Wiley and sons, 2018
2. Expert Systems by Peter Jackson, third edition, 2010, Pearson Education.

References:

1. Concepts and Techniques of Geographic Information Systems, CP Lo, Albert K W Yeung, 2005 Prantice Hall of India
2. Geographic Information Systems – An introduction by Tor Bernhardsen, John Wiley and Sons, Inc., New York, 2002.
3. Remote sensing and Image interpretation by Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc., New York, 2004.
4. Geographical Information Systems – Principles and Applications, Volume I & II, edited by David J. Maguire, Micheal F Goodchild and David W Rhind, John Wiley Sons. Inc., New York 2001.

Course Outcomes:

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

1. Explain the concept spatial data types and models
2. Summarize the data Sources and data entry
3. Summarize the GIS data processing
4. Explain the spatial data analysis and data visualization
5. Explain the advanced spatial data analysis and modelling

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					3				3		3		2	3
CO2	3	3			3	3				3		3	1	2	3
CO3	3	3			2	2			3			2	2	2	3
CO4		3			2	2			3			3	2	2	3
CO5		2			3				2			2	2	2	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2311	E-WASTE MANAGEMENT	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course focuses on overall scenario of E-Waste management in India in comparison with other countries around the globe. The present scenario of E-Waste management in India will be discussed along the role of various stakeholders. Impacts on effects of recycling and management of Electronic Waste on human health, environment and society will also be presented. This will be followed by the control measures and the E-Waste management Rules of India and around the World will be compared.

Course Educational Objectives:

- Course will introduce about the effective mechanism to regulate generation, collection, storage, transport, import, export, recycling, treatment and disposal of e-wastes and their legislative rules.

UNIT 1 **8 hours**

E- waste; composition and generation. Global context in e- waste; E-waste pollutants, E waste hazardous properties, Effects of pollutant (E- waste) on human health and surrounding environment, domestic e-waste disposal.

UNIT 2 **8 hours**

Basic principles of E waste management, Component of E waste management, Technologies for recovery of resources from electronic waste, resource recovery potential of e-waste, steps in recycling and recovery of materials-mechanical processing, technologies for recovery of materials,

UNIT 3 **8 hours**

Import of hazardous e-waste in India; India's stand on liberalizing import rules, E-waste economy in the organized and unorganized sector. Estimation and recycling of e-waste in metro cities of India. Occupational and environmental health perspectives of recycling e-waste in India.

UNIT 4 **8 hours**

Extended Producers Responsibility (EPR), Producer-Public-Government cooperation, Administrative Controls & Engineering controls, monitoring of compliance of Rules, Effective regulatory mechanism strengthened by manpower and technical expertise, Reduction of waste at source.

UNIT 5 **8 hours**

E-waste (Management and Handling) Rules, 2011; and E-Waste (Management) Rules, 2016 - Salient Features and its likely implication. Government assistance for TSDF. Case studies.

Text Books

1. Hester R.E., and Harrison R.M. 2009. Electronic Waste Management. Science.

References:

1. Fowler B. 2017. Electronic Waste – 1 st Edition (Toxicology and Public Health Issues). Elsevier.

2. Johri R., "E-waste: implications, regulations, and management in India and current global best practices", TERI Press, New Delhi.

Course Outcomes:

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

1. Describe various environmental impacts of e-waste on society – L2.
2. Explain concepts learned under e-waste management hierarchy – L2.
3. Summarize the rules towards import of e-waste – L2
4. Paraphrase various control measures in e-waste generation – L2.
5. Explain and summarize various e-waste management rules – L4.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2				3					2	3	3	1
CO2	3	2	2				3	2				2	2	2	1
CO3	2	2	3			1							2	3	2
CO4	2	3	2				2	2				2	2	2	1
CO5	2	2	2		2	2			1	1		2	2	2	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2321	SMART CITY TECHNOLOGIES	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course will help to learn about the smart city technologies and how to make the best of smart technologies in your cities' legacy infrastructures. This course will develop an understanding of urban infrastructure and the main principles for urban infrastructure management. The student will understand the key components that makes a smart urban infrastructure system and will develop a special understanding of the Smart Transport & Energy Infrastructure.

Course Educational Objectives:

- To provide insight on smart cities
- To understand the concepts of energy management
- To create awareness on ITS
- To understand smart monitoring of water supply
- To learn the principles of Reduce, Reuse and Recycle in waste management

UNIT 1 **5 hours**

Challenge of Urbanization, Introduction to the Smart Cities, Features, Digitalization, General Implications of digitalization on cities, Perspectives on Smart Cities.

UNIT 2 **5 hours**

Smart Meters and Management, Renewable Sources of Energy, Energy Efficient Green Buildings.

UNIT 3 **6 hours**

Smart Parking, Intelligent Traffic Management, Integrated Multi-Model Transport.

UNIT 4 **6 hours**

Smart Meters & Management, Leakage Identification, Preventive Maintenance, Water Quality Monitoring.

UNIT 5 **6 hours**

Waste to Energy & Fuel, Waste to Compost, Wastewater treatment, concepts of recycling and reduction of commercial and domestic waste

Textbooks:

1. Smart Cities – Mission Statement and Guidelines – Ministry of Urban Development, Govt of India, 2015
2. G Halegoua,Smart Cities, MIT Press, 2020

References:

1. **1.** T.M. Vinod Kumar, GIS for Smart Cities, Gopal Publishing 2015
2. P.P. Anil Kumar, Introduction to Smart Cities, Pearson Publications, 2019
3. L Neckermann, Smart Cities Smart Mobility, Matador, 2018

Course Outcomes:

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

1. demonstrate knowledge on smart cities.
2. apply the smart solutions for energy management.
3. analyse various urban mobility options
4. illustrate different smart water management techniques
5. describe effective management of commercial and domestic waste

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					3	1			2	1	1	2	2	2
CO2	3	2		2	1	3			2	2			2	2	2
CO3	3	2		2	1	3			2	2			2	2	2
CO4	3	2		2	1	3			2	2			2	2	2
CO5						3			2			1	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL2331	Safety Engineering	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co- requisite	None						
Preferable exposure	None						

Course Description:

This course aims to make the students well-versed with the latest safety and health regulations and the Indian Standards applicable to the industries. At the end of this course, the students will be able to plan, assess, analyze and manage the hazardous safety practices and device measures, organizational structure and mechanism to ensure safety.

Course Educational Objectives:

1. To equip students on the key terminologies related to safety
2. To enable student to understand and the metrics of safety and reliability
3. To provide fire safety related knowledge and provision that must to be followed in industries
4. To know environment safety and health related organizational design in industries
5. To provide knowledge on codes and provisions which must be complied in any industry.

UNIT 1 **Introduction** 8 hours

Introduction of key terminologies: Quality, Reliability, Maintainability, Availability, Risk and Safety; Probabilistic Risk Assessment/Probabilistic Safety Assessment.

UNIT 2 **Safety and Reliability** 8 hours

Safety function deployment; Safety vs reliability – quantification of basic events (repair to failure, repair-failure-repair, and combined processes
Accident theories, Risk versus hazard, Lead and lag indicators; Cost of Safety; Accident investigation and analysis, Application of virtual reality;

UNIT 3 **Fire Safety** 8 hours

Fire safety and detection; provisions of fire safety in different industries (buildings, offices, industries etc); Fire protection systems; Safety standards on fire safety, compliance of safety standards.

UNIT 4 **Environment Safety and Health (ES&H)** 8 hours

Environment Safety and Health (ES&H) – introduction, organisational structure, Continuous Improvement of Environment Safety and Health, Performance Metrics and Performance Indicators

UNIT 5 **Occupational Health and Safety, Codes and Case studies** 8 hours

The Occupational Safety and Health Act (OSH Act) and Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Management Systems (OSHMS) - OSHAS 18001 and OSHMS; ILO guidelines, Safety standards, compliance of safety standards
Safety related case studies and student presentations.

Textbooks:

1. Ajit, A. K., Srividya, V., & Karanki, D. R. 2016. ***Reliability and Safety Engineering*** (2nd ed.). Springer.
2. Goetsch, D. L. 2016. ***Occupational Safety and Health for Technologists, Engineers, and Managers*** (8th ed.). Pearson.
3. Alston, F., & Millikin, E. J. 2016. ***Guide to Environment Safety and Health Management***. CRC Press.

Course Outcomes:

1. At the end of unit 1, the student will realise and understand safety importance in the era of industry 4.0.
2. At the end of unit 2, the student can apply site safety management concepts.
3. At the end of unit 3, the student can structure the functioning of safety from organisational perspective.
4. At the end of unit 4, the student develops and performs site safety audit.
5. At the end of unit 5, the student will critically evaluate site safety based on recent advances and case studies.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS12	PSO1	PSO2	PSO3
CO1	1	1	2	1	1		3		1		3	1	2	1	1
CO2	1	2	1	1			3	2		1	3	1	1	1	1
CO3	1	1	1	1			3				2	1	3		1
CO4	1	3	2		1	1	3				2	2	3		2
CO5	1	1	3				3				3		3		2

APPROVED IN:	
BOS : 13-01-2023	**ACADEMIC COUNCIL: 16-05-2023**
SDG No. & Statement:	
SDG Justification:	

CIVL2341	Construction Safety	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co- requisite	None						
Preferable exposure	None						

Course Description:

This course aims to make the students well-versed with the latest safety and health regulations and the Indian Standards applicable to the construction industry. At the end of this course, the students will be able to plan, assess, analyse and manage the hazardous construction project sites.

Course Educational Objectives:

1. To bring safety awareness and realization of safety in construction projects.
2. To enable understanding on site safety measures.
3. To understand and structure safety from organizational perspectives.
4. To know the site safety metrics.
5. To be aware of advances in safety and application of BIM for safety.

UNIT 1 **Introduction to Safety** 8 hours

Health, safety and Environment Management; Case study for Safety awareness; Occupational health Safety; Accident-causation; Safety -Critical Operations in Construction Projects;

UNIT 2 **Site Safety** 8 hours

Safety during Site transport and material handling; Safety during shuttering, centering & scaffolding; safety in structural Steel Erection; Demolition;

UNIT 3 **Safety Organisation** 8 hours

Safety organization and management; Accident reporting, investigation & prevention; Planning for safety budget, safety culture; Role of stakeholders in safety; Environment Safety and Health (ES&H).

UNIT 4 **Safety management** 8 hours

Safety audit; Check list safety at Workplace; Check list construction safety; Safety- High rise construction;

UNIT 5 **Advances in safety and student case studies** 8 hours

Safety Ergonomics in construction; Use of Digital Technologies in Construction Management, Safety - Smart building and IOT, BIM & safety; Case Study -Site safety demonstration from a construction project; Student Case studies on safety;

Textbooks:

1. Jha, K. N., Patel, D. A., & Singh, A. 2022. ***Construction Safety Management*** (1st ed.). Pearson.
2. IS and OSHA Codes

References:

1. Lingard, H. & Rowlinson, S. (2005) Occupational health and Safety in Construction Project Management, Spon Press.
2. Holt, A.S.J. (2005) Principles of Construction Safety,Wiley-Blackwell Publishers
3. MacCollum, D.V. (2007) Construction Safety Engineering Principles, McGraw Hill Publishers
4. Hinze, J.W. (1997) Construction Safety, Prentice Hall
5. MacCollum, D.V. (1995) Construction SafetyPlanning, John Wiley & Sons
6. Reese, C.D. & Eidson, J.V. (2006) Handbook of OSHA Construction Safety and Health, Taylor & Francis.
7. Bhattacharjee, S.K. (2011) Safety Management in Construction, Khanna Publishers
8. Li, R.Y.M. & Poon, S.W. (2013) Construction Safety, Springer Publishers
9. Few IS Codes & journal papers
10. News paper clippings

Course Outcomes:

1. At the end of unit 1, the student will realise and understand safety importance
2. At the end of unit 2, the student can apply site safety management concepts
3. At the end of unit 3, the student can structure the functioning of safety from organisational perspective
4. At the end of unit 4, the student develops and performs site safety audit
5. At the end of unit 5, the student will critically evaluate site safety based on recent advances and case studies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS12	PSO1	PSO2	PSO3
CO1	1			1			3		1			1		1	1
CO2	1		1	1			3	1				1		1	1
CO3	1	3		1	2		3				2	1	3	2	3
CO4	1	3		1			3				2	2	3	2	3
CO5	1	3		1			3		1		3	3	3	2	3

APPROVED IN:	
BOS : 13-01-2023	**ACADEMIC COUNCIL: 16-05-2023**
SDG No. & Statement:	
SDG Justification:	

CIVL2351	Computational Methods in Civil Engineering	L	T	P	S	J	C
		2	0	2	0	0	3
Pre-requisite	None						
Co- requisite	None						
Preferable exposure	None						

Course Description:

This course is designed to expose the learners to the applications of various numerical techniques towards the solution of problems involved in Civil Engineering. The problems range from those related to solution of equations in structural analysis to problems related to in-situ estimation of area, volume etc. The learners would also be exposed to the mathematical tool MatLab for solution of the problems computationally.

Course Educational Objectives:

1. To apply the solution techniques of linear equations to slope deflection method.
2. To identify ways to apply numerical integration techniques to Civil Engineering problems.
3. To experiment with interpolation and extrapolation techniques as applicable to Civil Engineering problems.
4. To organize the ideas of data analysis to problems of Civil Engineering.
5. To illustrate the philosophy of finite difference method in problems of structural analysis.

UNIT 1 5 hours

Linear system of equations: Problems in formulation of simultaneous equations, solution of simultaneous equations using Gauss Elimination method, solution of simultaneous equations by using iterative method – Gauss Seidal iterative method (max 3 unknowns).

UNIT 2 5 hours

Numerical Integration: Determination of areas and volumes, calculation of volume of earthwork using trapezoidal rule and Simpson's rule, measurement of discharge through rivers using Weddle's rule, development of computer programs for trapezoidal rule, Simpsons 1/3rd rule, Simpsons 3/8th rule, Boole's and Weddle's rules, development of computer programs for trapezoidal and Simpsons 1/3rd rule.

UNIT 3 6 hours

Interpolation: Forward differences, backward differences, central differences, interpolation using difference techniques, forecasting of traffic demand, forecasting of water demand for a city and other applications of Civil Engineering problems.

UNIT 4 6 hours

Data Analysis: Calculation of mean, variance, standard deviation, coefficient of variation of a sample, construction of histograms and determination of mean and standard deviation of cube strengths of concrete, determination of correlation coefficient of correlation such as cube strength vs cylinder strength of concrete and other civil engineering problems.

UNIT 5 6 hours

Finite Difference Method: Introduction, application of finite difference method in the determination of deflections of beams, indeterminate beams (propped cantilever beam) determination of

i)Deflections at the center of simply beam subjected to UDL w per unit run over the entire span.

ii)Deflections at the center of simply beam subjected to concentrated load at the mid span.

iii) Prop reaction and deflection at center beam subjected to UDL over the entire span.

iv) Prop reaction and deflection at center of beam subjected to concentrated load at the center.

List of Experiments

The following experiments will be carried out in MatLab

- Formulate set of simultaneous equations and solutions for the analysis
- of continuous beam.
- Developing a computer program for the analysis of continuous beam
- and solving the unknowns using Gauss-Seidal method (maximum 9
- Unknowns).
- Determination of cross sectional area of a road using trapezoidal rule.
- Determination of cross sectional area of a road using Simpsons rule.
- Determination of flow through a canal using Weddle's rule.
- Forecasting of traffic demand using extrapolation algorithms.
- Forecasting of water requirement using using extrapolation algorithms
- Determination of mean, standard deviation of a given sample of
- Concrete strengths.
- Developing correlation between cube strengths and cylinder strengths
- Determination of deflection at the centre of simply supported beam subjected to UDL w per unit run over the entire span and using finite difference method.
- Determination of deflection at the centre of a propped cantilever beam subjected to concentrated load at the centre of span using finite difference method.
- Construction of influence line diagram for Bending Moment in simply supported beam.

Textbooks:

1. S.P. Venkateshan, P. Swaminathan, Computational Methods in Engineering, 2/e, Academic Press - Published by Elsevier, ISBN 978-9389212822, 2021.
2. R. Pratap, Getting Started with MATLAB, 7/e, Oxford University Press, ISBN 978-0190091972, 2019.
3. M.K. Jain, S.R.K. Iyengar, R.K. Jain , Numerical Methods: For Scientific And Engineering Computation, 7/e, New Age International Publishers, ISBN 978-9387477254, 2019.

References:

1. S.C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, 4/e, McGraw-Hill Companies Inc, ISBN 978-9353167288, 2019.

2. S. Chapra, and R, Canale, Numerical Methods for Engineers, 7/e, McGraw-Hill Higher Education, ISBN 978-9352602131, 2016

Course Outcomes:

After completion of this course, the learner will be able to

- Outline various techniques for solving linear slope deflection method equations (L2).
- Assess the advantage of numerical integration techniques when applied to Civil Engineering problems (L5).
- Justify the use of interpolation and extrapolation to Civil Engineering problems. (L5).
- Appraise the basic concepts of statistical analysis as applicable to Civil Engineering problems (L5).
- Evaluate the advantage of using finite difference techniques in structural analysis. (L5).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS12	PSO1	PSO2	PSO3
CO1	2	1	1			1	1	1				3	2	3	2
CO2	2	2	2			2	1	2				3	2	3	2
CO3	3	2	2	2	2	2	1	1	2			3	1	3	2
CO4	3	2	2	2	2	2	2	1	2	1		3	2	3	2
CO5	3	3	2	2	2	2	2	2	3	2		3	2	3	2

APPROVED IN:	
BOS : 13-01-2023	**ACADEMIC COUNCIL: 16-05-2023**
SDG No. & Statement:	
SDG Justification:	

CIVL2371	Planning of Infrastructure Projects	L	T	P	S	J	C
SDG No. 4		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course aims to provide students with an understanding of the practical risks and difficulties involved in managing infrastructure. It covers the infrastructure planning process, the state of infrastructure in India, and examines various methods and evaluations used for planning infrastructure projects. The course also includes real-world case studies and innovative solutions to improve the execution of infrastructure projects. Guest lectures are included to ensure the material is relevant and applicable to the industry. Upon completion of the course, students will be prepared to work in construction organizations such as L&T, GMR Infra, consulting firms such as PwC, Deloitte, or quasi-government bodies, or they can become planning and management consultants.

Course Educational Objectives:

- To introduce students to the concepts and practices involved in infrastructure planning and development
- To focus on the Indian infrastructure sector and provide students with the skills to choose the best options using scientific methodologies
- To enable the student to understand various types of evaluating infrastructure projects
- To enable the student to understand the financial evaluation of infrastructure projects.
- To enable students to apply their knowledge to real-world cases, and make informed decisions about infrastructure planning and development.

UNIT 1 **Planning of infrastructure - Introduction** 7 hours

Definitions of infrastructure; Economic multiplier effects of infrastructure; Typical infrastructure planning steps; Planning and appraisal of major infrastructure projects; Screening of project ideas; Life cycle analysis;

UNIT 2 **Scenarios of Indian Infrastructure** 8 hours

The Infrastructure Scenario in India, Urban Infrastructure in India, The Power Sector in India, The Water Sector in India, Transportation Infrastructure, Telecommunications sector in India, Rural Infrastructure in India, Road Infrastructure, Development in India, Rural Road Development in India - Opportunities and Challenges, Key Issues - Sector-wise;

UNIT 3 **Economic Analysis** 8 hours

Economic Analysis – Concepts and Applications, Principles of methodologies for economic analysis of public works, Social welfare function, indifference curves and trade-offs, Demand curves and price elasticities; Benefit-cost ratio and internal rate of return; Shadow pricing; Accounting for risk and uncertainty;

UNIT 4 **Financial Evaluation** 8 hours

Financial Evaluation - Time value of money, Investment criteria, Project cash flows – elements and basic principles of estimation, Financial estimates and projections, Cost of capital, Rate of return;

UNIT 5 **Student Case Studies** 8 hours

Case studies from developed and developing countries of notable megaprojects, smart city projects, major urban infrastructure projects etc. Student presentations on hypothetical case studies (or) with problem-based learning methodology

Textbooks:

1. P. Chandra, *Projects: Planning, analysis, selection, financing, implementation, and review*, Tata McGraw-Hill, New Delhi, 2009.
2. Goodman, A., & Hastak, M. 2015. ***Infrastructure Planning, Engineering, and Economics*** (2nd ed.). New York: McGraw Hill Professional and ASCE Press.

References:

1. J. Parkin and D. Sharma, *Infrastructure planning*, Thomas Telford, London, 1999.
2. T. J. Webster, *Managerial economics: Theory and practices*, Elsevier, New Delhi, 2003.
3. J. D. Finnerty, *Project financing - Asset-based financial engineering*, John Wiley & Sons, New York, 1996.
4. L. Squire and H. G.van der Tak, *Economic analysis of projects*, John Hopkins University Press, London, 1975.

CIVL3091	ADVANCED DESIGN OF STEEL STRUCTURES	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	Design of Steel Structures						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This is an advanced course useful for the student to enable them the design of advanced Steel structures The student will be able to design various components of plate girders under different loading condition. The design of column foundations and gantry girders will be helpful in designing industrial structures.

Course Educational Objectives:

- To train on the design of welded plate girder without stiffeners.
- To train on the design of welded plate girder with stiffeners.
- To enable the design of truss members.
- To demonstrate the design of column bases.
- To familiarize with the design of Gantry Girder.

UNIT 1 **Welded Plate Girders** **8 hours**

Components of a plate girder, economical depth, design of flanges, design of cross section of plate girders, design of connection.

UNIT 2 **Welded Plate Girders** **8 hours**

Web stiffeners - design of vertical, horizontal and bearing stiffener, web splice.

UNIT 3 **Roof Trusses** **8 hours**

Types of trusses, economical spacing of roof trusses, loads on roof trusses, estimation of wind load on roof trusses as per IS:875, design of members of roof truss and joints, design of purlins.

UNIT 4 **Column Foundations** **8 hours**

Slab base, gusset base and grillage foundations for axially loaded columns.

UNIT 5 **Gantry Girder** **10 hours**

Introduction - loading consideration and maximum load effect - selection of gantry girder – design of gantry girders for primary loads only.

Text Books:

1. S.K. Duggal, Limit state Design of steel structures, 2/e, Tata McGraw Hill, 2017.
2. N. Subramanyam, Design of Steel Structures, 2/e, Oxford University Press, 2016.

References:

1. V.L. Shah and Veena Gore, Limit State Design of steel structures IS:800- 2007, Structures Publications, 2012.
2. M.L. Gambhir, Fundamentals of Structural Steel Design, McGraw Hill Education, 2013.
3. Ramachandra and V. Gehlot, Design of Steel Structures, 2/e, Scientific Publishers, 2015

Course Outcomes:

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

1. design a welded plate girder without stiffeners (L6).
2. design a welded plate girder with stiffeners (L6).
3. design of members n a truss (L6).
4. design of column bases. (L6).
5. design of Gantry Girder (L6).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	1	2	2	2	2	1	1	1	3	3	2
CO2	2	2	3	3	1	2	2	2	2	1	1	1	3	3	2
CO3	2	2	3	3	1	2	2	2	2	1	1	1	3	3	2
CO4	2	2	3	3	1	2	2	2	2	1	1	1	3	3	2
CO5	2	2	3	3	1	2	2	2	2	1	1	1	3	3	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3101	ADVANCED CONCRETE TECHNOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**Nil**						
Co-requisite	**Nil**						
Preferable exposure	**Nil**						

Course Educational Objectives:

- To describe the microstructure of concrete
- To enumerate the effects of creep and shrinkage
- To summarize the durability properties
- To review special concretes
- To explain the statistical parameters of concrete

UNIT 1 Structure of Concrete 8 hours

Introduction, Structural Levels, Structure of Concrete in Nanometer Scale: C–S–H Structure, Transition Zone in Concrete, Microstructural Engineering

Strength properties of concrete

Relation between compressive and tensile strength, Fatigue strength, Impact Strength, Resistance to Abrasion, Bond to reinforcement

UNIT 2 Elasticity, Creep and Shrinkage 8 hours

Elasticity, Factors influencing the modulus of elasticity, Poisson's ratio, Creep, Factors influencing creep, Effects of creep, Shrinkage and swelling, Drying shrinkage, Carbonation shrinkage.

UNIT 3 Permeability and Durability 8 hours

Permeability, Sulphate attack, Attack by sea water, Acid attack, Alkali-aggregate, Corrosion of reinforcement.

UNIT 4 Special Concrete 8 hours

Polymer-concrete composites, Recycled concrete aggregate, Fiber reinforced concrete, High-Performance Concrete, Self-Consolidating (Self-Compacting) Concrete, Structural Lightweight Concrete, Heavyweight Concrete

UNIT 5 Mix design 8 hours

nominal mix- design mix – concept of mix design - variables of proportioning - general considerations - factors considered in the design of concrete mix- various methods of mix design - design of concrete mix as per IS 10262-2019

Statistical quality control of concrete – mean strength – standard deviation – coefficient of variation – sampling - testing - acceptance criteria.

Text Books:

1. Concrete Technology by A.M.Neville and J.J.Brooks, Pearson Education Limited
2. Advanced Concrete Technology by Zongjin Li, John Wiley & Sons.

References

1. Advanced Concrete Technology – Concrete Properties by John Newman and Ben Sang Choo, Elesvier

Course Outcomes:

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

- Explain the microstructure of concrete
- Describe creep and shrinkage
- Enumerate various durability properties
- Recommend special concrete for different purposes
- Calculate the statistical parameters of concrete.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	0	0	0	1	0	0	0	2	2	1
CO2	2	2	1	2	1	0	0	0	1	0	0	0	2	2	1
CO3	2	2	1	2	3	1	1	0	1	0	0	1	2	2	1
CO4	2	2	1	2	1	1	1	0	1	0	1	1	2	2	2
CO5	2	2	3	2	2	3	3	3	2	1	1	1	2	2	3

APPROVED IN:

BOS : 24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3111	GROUND IMPROVEMENT TECHNIQUES	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	Geotechnical Engineering & Foundation Engineering						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course introduces the need for ground improvements and brief descriptions of methods used for cohesive and cohesionless soils. Detailed procedures of ground improvement techniques such as compaction, vibro-floatation and stone column, preloading, soil nailing and reinforced earth, dewatering techniques, and deep soil mixing will be covered in this course. Basic concepts of soil reinforcement using different types of geosynthetics and their wide applications are also discussed. The various grouting materials and their techniques are also covered in this course.

Course Educational Objectives:

- To familiarize the various types of improvement methods of engineering properties of soils.
- To study the need and various methods of dewatering for ground improvement
- To expose the various methods of in situ densification of cohesive and cohesion less soils
- To acquaint the concept of reinforcement and various applications of reinforcement for soil
- To demonstrate the different grouting techniques and materials for stabilization of soil

UNIT 1 Introduction 8 hour

Role of ground improvement in foundation engineering, methods of ground improvement, geotechnical problems in alluvial, laterite and black cotton soils, selection of suitable ground improvement techniques based on soil condition.

UNIT 2 Drainage and Dewatering 9 hours

Drainage techniques, well points, vacuum and electro osmotic methods, seepage analysis for two dimensional flow-fully and partially penetrating slots in homogenous deposits (Simple cases only), Analysis methods for dewatering of soils.

UNIT 3 In situ Treatment of Cohesionless and Cohesive Soils 9 hours

Institute classification of cohesionless and consolidation of cohesive soils, dynamic compaction and consolidation, fibrillation, sand pile compaction, preloading with sand drains and fabric drains, stone columns, lime piles, installation techniques only - relative merits of various methods and their limitations.

UNIT 4 **Earth Reinforcement** **8 hours**

Concept of reinforcement, types of reinforcement material, applications of reinforced earth, use of geotextiles for filtration, drainage and separation in road and other works, use of Geogrids, Geocells, Gemmates.

UNIT 5 **Grout Techniques** **8 hours**

Types of grouts, types of grouting, grouting equipment and machinery, injection methods, grout monitoring, stabilization with cement, lime and chemicals, stabilization of expansive soils, Permeation grouting, Compaction grouting, Displacement grouting.

Textbooks:

1. R.M. Koerner, Construction and Geotechnical Methods in Foundation Engineering, Tata McGraw Hill, 1994.
2. Dr.P. Purushothama Raj, Ground Improvement Techniques, Tata McGraw Hill,2016.

References:

1. M.P. Moseley, Ground Improvement Block, IE Academic and Professional, Chapman and Hall, 2004.
2. J.E.P. Jones, Earth Reinforcement and Soil Structure, Butterworths, 1996.

NPTEL Links

Unit 1:
https://nptel.ac.in/courses/105108075/
https://nptel.ac.in/courses/105108075/2
https://nptel.ac.in/courses/105108075/3
Unit 2:
https://nptel.ac.in/courses/105108075/12
https://nptel.ac.in/courses/105108075/13
https://nptel.ac.in/courses/105108075/14
Unit 3:
https://nptel.ac.in/courses/105108075/7
https://nptel.ac.in/courses/105108075/8
https://nptel.ac.in/courses/105108075/6
Unit 4:
https://nptel.ac.in/downloads/105106052/
Unit 5:
https://nptel.ac.in/courses/105108075/21

Course Outcomes:

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

1. illustrate the importance of ground improvement techniques – L2
2. explain various drainage and dewatering techniques to reduce the consolidation time – L2
3. identify the various in situ densification process for cohesionless and cohesive soils-L3
4. apply the principles of soil reinforcement and confinement in the constructions – L3
5. demonstrate the stabilization of soils using grouting techniques –L2

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1			1						2	1	2
CO2	2	1	2	1								2	1	1	1
CO3	1			1		1							1	1	
CO4	1	2	2								1		1	1	2
CO5	1		1		2								1	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3121	Transportation Infrastructure Engineering	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course imparts the student's knowledge of planning, design, construction and maintenance of railway tracks. The students acquire proficiency in the application of modern techniques such as GIS, GPS and remote sensing in Railway Engineering. The student develops skills on airport planning and design with the prime focus on runway and taxiway geometrics. Students become conversant with the definition, purpose, location and materials of coastal structures such as piers, breakwaters, wharves, jetties, quays and fenders. The students acquire knowledge on site reconnaissance for location and planning of harbors

Course Educational Objectives:

The purpose of this course is to

- Familiarize about the history of non-highway transportation i.e. Railways, Air Transportation, Harbor and Dock Engineering
- Enable to design railway infrastructure along with design and analysis of railway track system
- Explain about layout and design of airport
- Familiarize on the orientation of the runways and geometrical design of the airport infrastructure,
- Impart knowledge on planning of a seaport and its infrastructure and aids

UNIT 1 Railways - Introduction and Planning 8 hours

Development of railways in India, components of a permanent way and its functions, rails, sleepers, ballast, formation, rail fittings and fastenings, comparison of roadways and railways, engineering surveys for track alignment and GIS, GPS and RS applications, track alignment considerations, track construction and track maintenance, track drainage, introduction to modern developments in railways.

UNIT 2 Railways – Geometric Design, Points and Crossings, Signalling and Interlocking 9 hours

Gradient and grade compensation on curves, speed on curves, super elevation and negative super elevation, widening of gauge on curves, types of stations and station yards, station equipment's, types of points switch and crossings, design calculation of turnout, various types of track junctions, signaling and interlocking, different types of signals, their working and location, control systems of signals, track circuiting.

UNIT 3 **Airport Engineering: Layout and Design** **9 hours**

Introduction, classification of airports, factors influencing site selection, components of airport landing areas, terminal area and terminal buildings, cross sectional components of runway and taxiway, components, drainage, airport zoning, clear zone, approach zone, buffer zone, turning zone, clearance over highways and railways.

UNIT 4 **Airport Planning and Air Traffic Control** **8 hours**

Hangers and helipads, turning radius, taxiway as per Indian standards, wind rose diagram, runway orientation, landing aids, air traffic control, airfield marking and lighting- sign, aircraft parking system, flight planning and operations, design standards, planning and design of airport as per Indian condition.

UNIT 5 **Harbors Docks and Management** **8 hours**

Dock, different types, functional design and various types and their usage, navigational aids, necessity and type of signals and different types of dredges and their applications, classification and requirements of harbors, classification and construction, wharves, piers and bulkheads, dolphins, fender and other mooring devices, typical layout of existing harbors

Text Books:

1. Ashford N.J., MumayizS.A., and PWright.H., Airport Engineering: Planning, Design and Development of 21stCentury Airports, 4/e, John Wiley and Sons,2011
2. Subhash C. S, and Arora S, A course in Railway Engineering, 7/e, Dhanpat Rai and sons, Delhi, 2009
3. Srinivasan R., Harbour, Dock and Tunnel Engineering, 1/e, Charotar Publications, 2016

References:

1. Agarwal M.M., Indian Railway Track, 5/e, Prabha and Co, 2007
2. Anita K.F., “Railway Track”, 1/e, New Book Company, 2000
3. Young S.B., and Wells A.T., Airport Planning and Management, 6/e, McGraw-Hill,2011
4. NPTEL Video Course for Transportation Engineering II https://nptel.ac.in/courses/105107123/

Course Outcomes:

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

1. Summarize the history of the railway development in India, track alignments, construction and maintenance**[L2]**
2. apply the concepts in designing of railway tracks, curves, crossings, signaling and interlocking**[L3]**
3. list the elements of airport engineering and design airport terminals along with runways**[L1]**
4. demonstrate knowledge on helipads, windrode diagrams and air traffic control**[L2]**
5. develop knowledge on harbor and dock engineering such as different types, functional design, navigational aids, types of signals, buoys, beacons, wharves, piers and Bulkheads, Dolphins, Fender and other mooring devices**[L3]**

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					3	1			2	1	1	2	2	2
CO2	3	2		2	1	3			2	2			2	2	2
CO3	3	2		2	1	3			2	2			2	2	2
CO4	3	2		2	1	3			2	2			2	2	2
CO5						3			2			1	2	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3131	ADVANCED WATER RESOURCES ENGINEERING	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**CIVL2061 - Water Resources Engineering**						
Co-requisite	**Nil**						
Preferable exposure	**Nil**						

Course Description:

The prerequisite for this course would be fluid mechanics and water resources engineering. This course helps the learner to acquire the comprehensive knowledge of gravity dams, earth dams, spillways. The learner will gain the knowledge on the principles of stability analysis of gravity dams and seepage analysis of earth dams. This course introduces the over view of spillways and design principles of stilling basins. The learner will gain the knowledge of design principles to design the minor irrigation structures of canal regulation works and cross drainage works.

Course Educational Objectives:

- to explain the forces acting on gravity dam, seepage analysis of earth dam
- to teach the principles of stability analysis and theories of subsurface flow
- to solve the problems related to stability analysis of gravity dam and earth dam.
- to design the Canal Regulator and Cross Drainage structures

UNIT 1 Gravity Dams 9 hours

Classification of dams, gravity dams: forces acting, elementary profile, safety criteria, stability analysis of gravity dam including earthquake effects, construction joints, openings in dams-galleries, foundation treatment of gravity dam.

UNIT 2 Earth Dams 9 hours

Types, causes for failure of earth dams, phreatic line, seepage analysis for homogeneous dams, stability analysis of earth dam by slip circle method, seepage control in earth dams.

UNIT 3 Spillways 9 hours

Essential requirements, spillway capacity, components, types of spillways and their working, profile of ogee spillway, spillway crest gates, energy dissipation below spillway, use of hydraulic jump as energy dissipator – design of stilling basins – IS standard basins.

UNIT 4 Diversion Head Works 9 hours

Location and components, weirs and barrages, causes of failure of weirs, design of impervious floor of weirs on permeable foundation, Bligh's, Lane's and Khosla's theories, hydraulic design of vertical drop weir,

UNIT 5 Canal Regulatory Works and Cross Drainage Works 9 hours

Canal Regulatory Works: Canal regulator – hydraulic design of canal head regulator and cross regulator.

Cross Drainage Works: Types, factors affecting the suitability of each type, hydraulic design of Aqueduct and Syphon Aqueduct (Type-III), Canal outlet and canal escape.

Text Books:

1. P.N. Modi, Irrigation Water Resources and Water Power Engineering, Standard Book House, Delhi
2. B.C.Punmia and Pande B.B.Lal, Irrigation and Water Power Engineering, Laxmi Publications Pvt. Ltd., New Delhi

References:

1. S.K.Garg, Irrigation Engineering, and Hydraulic Structures, Khanna Publishers, Delhi
2. Ch.SatyanarayanaMurty, Water Resources Engineering, New Age International, Delhi
3. K.R. Arora, Irrigation, Water Power and Water Resources Engineering, Standard Book Publishing, Delhi

Course Outcomes:

At the end of course the students will be able to

1. estimate the forces acting on gravity dams (L-2)
2. check the stability of gravity dams and earth dams (L-3)
3. apply the stability criteria of dams (L-4)
4. compute the required thickness of impervious floor(L-4)
5. design the Canal Regulator and Cross Drainage structures (L-6)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3			2	2		3			1	3		
CO2	3	3	3			2	2		3			1	3		
CO3	3	3	3			2	2		3			1	3		
CO4	3	3	3			2	2		3			1	3		
CO5	3	3	3			2	2		3			1	3		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3141	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	Nil						
Co-requisite	Nil						
Preferable exposure	Nil						

Course Description:
The Environmental Impact Assessment procedure in India has been developed primarily as an aid to the environmental planning of new developmental projects. EIA essentially is a preventive process and it seeks to avoid costly mistakes in project planning and development. The main focus of this course is to expose the students to the need, methodology, documentation and application of Environmental Impact Assessment and to develop the skill to prepare Environmental Management Plan

Course Educational Objectives:
- to introduce basic ideology of EIA
- to expose the procedure of EIA analysis
- to study various EIA methodologies
- to impart about environmental auditing
- to acquaint about the preparation of EIA statements for various industries

UNIT 1 **8 hours**
EIA – Introduction -Definition – Basic concepts and principles of EIA – Origin and development of EIA - Short-term and Long- term objectives – EIA guidelines 2006 (Notification of Government of India) — Merits and Demerits of EIA

UNIT 2 **8 hours**
Basis for Environment Impact Assessment – Types of impacts (Negative & Positive, Primary & Secondary, Reversible and Irreversible Tangible and Intangible) Components of EIA: Screening of Projects - Public Participation - Preparing environmental impact statements. Factors affecting E-I-A, Impact evaluation and analysis - preparation of Environmental Base map.

UNIT 3 **EIA Methodologies** **8 hours**
Introduction- Criteria for the selection of EIA Methodology, EIA methods - Adhoc Method, Checklist Approach, Matrix Methods, Network Methods, overlay methods- cost/benefit Analysis - Introduction and Methodology for the assessment of soil and ground water-Delineation of study area- Identification of actives.

UNIT 4 **Environmental Auditing** **8 hours**
Scope, Objectives and Procedures for environmental auditing. Types of environmental Audit- benefits of environmental audit- stages of Environmental Audit -Post Audit activities. Environmental Management System (EMS): EMS standards, The ISO 14000 series, The ISO 14001.

UNIT 5 **8 hours**
Preparation of Environmental Impact assessment statement for various Industries.

Text Books:

1. Y. Anjaneyulu., Environnemental Impact Assessment Methodologies , B. S. Publications, Kakinada, 2010.
2. N. S. Raman, A. R. Gajbhiye, S. R. Khandeshwar., Environnemental Impact Assessment, I.K.International Publishing house Pvt,Ltd, New Delhi,2014.
3. Anji Reddy Mareddy , Anil Shah , Naresh Davergave., Environmental Impact Assessment: Theory and Practice,Butterworth-Heinemann , 2017.

References

1. V.V.N. Murty, Madan K. Jha, “Land and Water Management Engineering”, Kalyani Publishers, 6 th Edition, 2013.
2. Charles H.Eccleston , Environnemental Impact Assessment-A Guide to Best Professional practices, CRC Press,Taylor&Franci

Course Outcomes:

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

1. outline the concepts and principles involved in EIA –L2
2. make use of environmental base map –L3
3. select best EIA methodology to assess the impact – L3
4. summarize the concepts of environmental audit –L2
5. analyze EIA statements of various industries –L5

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO0	PO10	PO11	PS12	PSO1	PSO2	PSO3
CO1	3	2	2				3					2	1	2	1
CO2	3	2	2				3	2				2	1	2	1
CO3	2	2	2			1	3					2	2	2	1
CO4	2	2	2				3	2				2	2	2	1
CO5	2	2	2		2	2	3		3	2		2	2	2	1

APPROVED IN:

BOS : 24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3151	Applications of GIS in Disaster Management	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**Nil**						
Co-requisite	**Nil**						
Preferable exposure	**Nil**						

Course Description:

The course aims at introducing various types of natural disasters and application of space inputs for disaster management and GIS techniques used for mapping, impact assessment, forewarning, preparedness and mitigation of adverse effects

Course Educational Objectives:

- To introduce about various natural disasters and institutional framework in India
- To understand RS & GIS applications in drought and forest fire
- To understand RS & GIS applications in cyclones and floods
- To understand RS & GIS applications in earthquakes and tsunami
- To understand RS & GIS applications in landslide and soil erosion

UNIT 1 Introduction 8 hours

Definition, classification of disasters, Institutional framework for disaster management in India, Satellites, and sensors for disaster management. Role of satellite-based communication systems in disaster management.

UNIT 2 Drought and Forest Fire 8 hours

Drought types and causes, delineation of drought vulnerable areas mapping, Use of RS and GIS in Meteorological, Hydrological drought and agricultural drought assessment, severity mapping and monitoring.

Forest Fire: Forest fire causes, forest fire management using geospatial information system, forest fire risk zonation mapping.

UNIT 3 Cyclones and Floods 8 hours

Cyclone formation, Life cycle of a cyclone, Cyclone tracking, Cyclone early warning, impact assessment and management.

Floods: Types of floods, causes and mitigation measures, flood early warning, flood affected area mapping and damage assessment, flood risk analysis using RS and GIS.

UNIT 4 Earthquakes and Tsunami 8 hours

Causes of earthquake, damage evaluation and loss estimation, RS and GIS application for post-quake rehabilitation, micro-level seismic zonation, Tsunami- types, causes, RS and GIS applications for post Tsunami damage assessment and rehabilitation.

UNIT 5 Landslide and Soil Erosion 8 hours

Landslides, causes, land slide susceptibility mapping, geospatial technology for landslide management.

Soil Erosion: Application of RS and GIS for soil erosion and sediment estimation, estimation of soil erosion, soil erosion mapping.

Text Books:

1. Amdahl G (2002) Disaster Response: GIS for Public Safety, Published by ESRI, Redlands California.
2. http://www.esri.com/news/arcnews/winter0102articles/gishomeland. html - visited on October 2002.

Course Outcomes:

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

1) Explain various natural disasters and institutional framework in India
2) Summarize RS & GIS applications in drought and forest fire
3) Summarize RS & GIS applications in cyclones and floods
4) Summarize the RS & GIS applications in earthquakes and tsunami
5) Summarize the RS & GIS applications in landslide and soil erosion

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 0	PO 10	PO 11	PS1 2	PS O1	PS O2	PSO 3
CO1	3	3				2	2		1			1			
CO2	3	3	2	2		2	2		1			1	2	1	
CO3	3	3	2	2		2	2		1			1	2	1	
CO4	3	3	2	2		2	2		1			1	2	1	
CO5	3	3	2	2		2	2		1			1	2	1	

APPROVED IN:

BOS : 24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3161	ROAD SAFETY MANAGEMENT	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:
The course shall give a broad knowledge in Road Safety Management. The aim of the course is to teach participants a scientific approach to and establish a system view of road safety. The course also addresses the core issues of Road Safety by first defining the problem on hand and then offering some proven ways and means with which Road Safety management can be enhanced under prevailing traffic conditions in Indian cities and regional corridors.

Course Educational Objectives:
1. To provide insight on road safety in global perspective
2. To understand the engineering aspects of road safety
3. To recognize different types of road crashes and establish importance of speed
4. To understand the importance of signs, signages and streetlight in promoting safety
5. To learn road safety policies practiced at national, state and district levels

UNIT 1 Introduction to Global Road Safety 8 hours
Road Causalities, Global Road Safety Plan, Systematic Approach to Road Safety, Road Safety Management, Haddon's Matrix, Vision Zero

UNIT 2 Road Safety Engineering 8 hours
Proactive vs. Reactive Interventions, Geometric Design Standards, Identification of Blackspots using Crash Data, Proposed Remedies.

UNIT 3 Road Crashes and Speed Management 8 hours
Road Crashes – Types, Contributing Factors, Speed vs. Crash Fatalities, Different Approaches to Speed, WHO recommendations for Speed Management, Self-Explaining and Forgiving Roads, Speed Management Techniques

UNIT 4 Intersection Safety and Effective Road Signs & Street Lighting 8 hours
Safe Intersections, Design Issues, Visibility and Safe Stopping Distance, Purpose of Road Signs and Markings, Variable Message Signs, Street Lighting.

UNIT 5 Road Safety Policies 8 hours
National Road Safety, Motor Vehicle Act 2019, Supreme Court Committee on Road Safety, Role of State and District Road Safety Councils

Text Books:
1. Book on Road Safety Signage & Signs – Ministry of Road Transport and Highway, Govt of India, 2015
2. G Tiwari and D Mohan, Transport Planning and Traffic Safety, CRC Press, 2016

References

1. Motor Vehicle Act 2019
2. Global Plan for the Decade of Action for Road Safety 2021-2030, World Health Organization (WHO), 2021.

Course Outcomes:

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

1. demonstrate knowledge on road safety in global perspective.
2. analyse the engineering aspects of road safety.
3. Classify different types of road crashes and establish importance of speed
4. illustrate understand the importance of signs, signages and streetlight in promoting safety
5. learn road safety policies practiced at national, state and district levels

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 0	PO 10	PO 11	PS1 2	PS O1	PS O2	PSO 3
CO1	2	2		2					2			2			
CO2	2	2		2					2			2			
CO3	2	2		2					2			2	2	2	
CO4	2	2		2					2			2	2	2	
CO5	2	2		2					2			2	2	2	

APPROVED IN:

BOS : 04-07-2022 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3171	PRESTRESSED CONCRETE	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Prestressed concrete is often preferred in construction of bridges and buildings. This course discusses on various materials used, types of prestressing system and prestressing losses. The student will be able to design prestressed concrete members including end block as per Indian Standard code.

Course Educational Objectives:

- To familiarize different prestressing methods.
- To explainthe analysis of prestressed concrete beams.
- To demonstrate various losses in prestressed concrete members.
- To impart the design of prestressed concrete members.
- To enable design of end block.

UNIT 1 Introduction and Systems of prestressing 8 hours

Introduction:
Basic concepts of prestressing, Historical Development, Need for high strength steel and concrete, Terminology, Advantages of prestressed concrete, Applications of prestressed concrete.
Systems of prestressing:
Classification of prestressed concrete. Pre tensioning techniques - long line system (Hoyer system), post - tensioning Techniques (a) Frizzante system and (b) Gifford Udall system.

UNIT 2 Analysis of prestress and Bending stresses 8 hours
Basic assumptions, Analysis of prestress, Resultant stresses at a section, Pressure line or thrust line and internal resisting couple, Concept of load balancing, Stresses in tendons, Cracking moment.

UNIT 3 Losses of Prestress 10 hours
Nature of losses of Prestress, Loss due to elastic deformation of concrete, Loss due to shrinkage of concrete, Loss of prestress due to creep of concrete, Loss of prestress due to relaxation of stress in steel, Loss of prestress due to friction, Loss due to Anchorage slip, Total losses allowed for in design.

UNIT 4 Design of prestressed concrete sections 8 hours

Design of sections for flexure.

UNIT 5 Anchorage zone stresses in post-tensioned members 8 hours

Introduction, Stress distribution in end block, Investigations on anchorage zone stresses, comparative analysis, Anchorage zone reinforcement.

Text Books:

1. **1.** N. Krishna Raju, Prestressed concrete, 4/e, Tata McGraw Hill, 2012.
2. G.S. Pandit, Prestressed concrete, CBS Publishers, 2014.

References:

1. P. Dayaratnam, Prestressed Concrete Structures, Oxford and IBH Publishing Company, 2014.
2. T.Y. Lin, and H. Ned, Burhns, Design of Prestressed Concrete Structures, 3/e, John Wiley and Sons, 2010.
3. H. Arthur, Nilson, Design of prestressed concrete, Wiley India Pvt.ltd, 2011.
   J.R. Libby, Modern prestressed concrete,CBS Publishers, 2007.

Course Outcomes:

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

1. distinguish between different prestressing methods (L4).
2. analyze prestressed concrete beams for flexure(L5).
3. estimate various losses in prestressed concrete members (L5).
4. design prestressed concrete beams (L6).
5. construct stress distribution diagram in end block (L6).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1			1		3				2	3	1	1
CO2	3	3	3	1		1		3	1			2	3	2	2
CO3	3	3	3	1		1		3	1			2	3	2	2
CO4	3	3	3	1		1		3	1			2	3	2	2
CO5	3	3	3	1		1		3	1			2	3	2	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

24-12-2021 ACADEMIC COUNCIL: 22nd AC (01-04-2022)

SDG No. & Statement:

SDG Justification:

CIVL3181	Bridge Engineering	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**Nil**						
Co-requisite	**Nil**						
Preferable exposure	**Nil**						

Course Educational Objectives:

- Explain basic concepts related to construction of bridges.
- Classify R.C.C. bridges and design culvert and T-beam bridge.
- List design principles of different steel bridges.
- Design substructure of bridge.
- Classify different bearings.

UNIT 1 Introduction and Investigation for Bridges 8 hours

Components Of a Bridge, Classification, Standard Specifications, Need for Investigation, Selection of Bridge Site, Preliminary Data to be Collected, Preliminary Drawings, Determination of Design Discharge, Economical Span, Location of Piers And Abutments, Vertical Clearance Above HFL, Scour Depth, Choice of Bridge Type, Importance of Proper Investigation.

UNIT 2 Design Consideration of RCC bridges 8 hours

Various types of bridges (brief description of each type), Design of R.C.C. Culverts (Class 70R loading) and T-Beam Bridges.

UNIT 3 Design Consideration of steel bridges 8 hours

Various types of steel bridges (brief description of each type), Design of welded plate girder bridge.

UNIT 4 Sub Structure for Bridges 8 hours

Pier and Abutments Caps; Materials for Piers and Abutments, Design of Pier, Design of Abutment, Backfill behind Abutment, Approach Slab.

UNIT 5 Bridge Bearings 8 hours

General features, types of bearings, design of elastomeric pad bearing

Text Books:

1. D. Johnson Victor, Essentials of Bridge Engineering, 6/e, Oxford and IBH Publishing, 2007.
2. Krishna Raju N., "Design of Bridges", 4th Edition, Oxford & IBH Publishing, 2010.

References

1. Jagadish. T.R, Jayaram. M.A, "Design of Bridge Structures", 2/e, Prentice Hall of India, 2009.
2. Ponnuswamy.S, Bridge Engineering, 2/e, Tata McGraw Hill Education, 2008.

Course Outcomes:
After completion of this course, the student will be able to

1. relate basic concepts for construction of bridges (L1)
2. design of a culvert and T-beam bridge (L6)
3. summarize design principles of different steel bridges (L2)
4. analyse and design the substructure for bridge (L4)
5. compare functionality of different bearings (L2)

CO-PO Mapping:

	P O 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 0	PO 10	PO 11	PS1 2	PS O1	PS O2	PSO 3
CO1	2	1	1			1		3				2	3	1	1
CO2	3	3	3	1		1		3	1			2	3	2	2
CO3	3	3	3	1		1		3	1			2	3	2	2
CO4	3	3	3	1		1		3	1			2	3	2	2
CO5	3	3	3	1		1		3	1			2	3	2	2

APPROVED IN:
BOS : 24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3191	GEOSYNTHETICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**Geotechnical Engineering, Foundation Engineering & Ground Improvement Techniques**						
Co-requisite	**Nil**						
Preferable exposure	**Nil**						

Course Description:

Geosynthetics are made of eco-environmental biodegradable polymeric resins or natural materials that maintain their needed performance such as durability, design strength, hydraulic property, etc., during the service period. The use of geosynthetics is, though, still novel in the field of civil engineering and construction industry, its use is nevertheless increasing every year in sectors such as reinforcement of fill, management of pore water pressure, foundations and pavements. These products are mainly categorized in to Geotextiles, Geogrids, Geomembranes, Geocomposites

Course Educational Objectives:

- To familiarize the evolution of new construction materials in geotechnical engineering and to initiate geosynthetic materials.
- To expose the properties and applications of different types of materials of geosynthetics.
- To acquaint the concepts of application of geotextiles for the functions of separation, reinforcement, stabilization, filtration, drainage and moisture barriers.
- To demonstrate the designing criteria of reinforced earth retaining walls, gabions, pond liners, covers for reservoirs, canal liners, landfill liners, caps and closures, dams and embankments.
- To study the additional advantages of geocomposites, geowebs and geocells, and moisture barriers and natural geotextiles etc. for applications to meet various functions.

UNIT 1 **Geosynthetics** **8 hours**

Introduction to Geosynthetics – Basic description – Polymeric materials– Uses and Applications. Properties and classification Geotextiles – Geogrids – Geomembranes – Geocomposites.

UNIT 2 Geotextiles 8 hours

Geotextiles as Separation – Reinforcement – Stabilization – Filtration – Drainage and Moisture barriers. Geogrids: Suitability for Reinforcement – Stabilization – Design considerations Gabions – Construction methods.

UNIT 3 Use of Geosynthetics in Roads 9 hours

Geosynthetics in road ways- applications- role of sub grade conditions-survivability-application in paved roads. Geosynthetics for separation and reinforcement in flexible pavements, Use of geosynthetics for construction of heavy container yards and railway lines

UNIT 4 Reinforced Earth Retaining Walls 9 hours

Components, Different types of walls like wrap-around walls, full-height panel walls, discrete-facing panel walls, modular block walls Design methods as per BS-8006 and FHWA methods Construction methods for reinforced soil retaining walls, Stability Analysis

UNIT 5 Geomembranes 8 hours

Pond Liners – Covers for Reservoirs – Canal Liners – Landfill Liners– Caps and closures, moisture barriers. Geocomposites: An added advantage – Geocomposites in Separation – Reinforcement – Filtration – Geocomposites as Geowebs and Geocells.

Text Books:

1. ‘An Introduction to Soil Reinforcement and Geosynthetics’ by G.L.SivakumarBabu (2009), Universities Press (India) Pvt. Ltd.
2. ‘Engineering with Geosynthetics’, by G. Venkatappa Rao and GVS Suryanarayana Raju – Tata McGraw Hill Publishing Company Limited – New Delhi.

References:

1. ‘Designing with Geosynthetics by Robert M. Koerner, Prantice Hall, and Eaglewood Cliffs, NJ 07632.
2. ‘Construction and Geotechnical Engineering using Synthetic Fabries’ by Robert M. Koerner and Josoph P. Welsh. John Willey and Sons, New York.

NPTEL Links

Module 1: https://nptel.ac.in/downloads/105106052/

https://nptel.ac.in/courses/105108075/module8/Lecture24.pdf

Module 2: https://nptel.ac.in/courses/105101143/downloads/Lecture%2016.pdf

Module 3: https://nptel.ac.in/courses/105101143/downloads/Lecture%2020.pdf

https://nptel.ac.in/courses/105101143/20

Module 4: https://nptel.ac.in/courses/105108075/module8/Lecture31.pdf

https://nptel.ac.in/courses/105101143/27

Module 5: https://nptel.ac.in/courses/105108075/23

Course Outcomes:

After completion of this course the student will be able to

1. demonstrate the various applications and different types of geosynthetic materials – L2
2. explain the concepts of geosynthetics for the functions of separation, reinforcement, stabilization, filtration, drainage and moisture barriers – L2
3. illustrate survivability requirements of geosynthetics in the field of roads and role of geosynthetics in sub grade soil – L2
4. outline the design considerations of reinforced earth retaining walls and gabions – L2
5. select suitable geomembrane for pond liners, covers for reservoirs, canal liners, landfill liners, caps and closures – L3

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1				2						**2**	**2**	**2**
CO2	2	1	1				2						**2**	**2**	**2**
CO3	2	2	1	3			2						**2**	**2**	**2**
CO4	3	3	2	2			2						**2**	**2**	**2**
CO5	3	3	2	2			2						**2**	**2**	**2**

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3201	ROAD SAFETY AUDITING	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The prime objective of the Roads Safety Audit is to address the safe operation of a roadway and to ensure high level of safety for all its users. This course exposes the various road safety policies nationally as well as internationally. Further, it attempts to address the problems relating to urban road safety, identifying the indicators of safety in urban areas and provide a comprehensive solution for urban road safety audit.

Course Educational Objectives:

- To explain different types of road accidents and causes
- To impart the road transport policies to prevent accidents
- To demonstrate road safety auditing techniques
- To focus on prioritizing of road safety improvement methods
- To familiarize on safety audit procedures

UNIT 1 Road Safety Policy-I 8 hours

The scale and nature of the road accident problem in the India and how it compares internationally. Road Safety responsibilities. Definition of road accidents and accident causation

UNIT 2 Road safety policy-II 9 hours

Role of road safety in national and local transport policy, managing the safety process, urban and rural road safety management, road safety research and recent road safety developments with special emphasis on pedestrian safety.

UNIT 3 Collision Prevention and reduction-I 9 hours

Road accidents, causes, recorded cases, method of recording, accident data, storing of accident data, the use of accident data, the use of accident data and interpretation of accident data.

UNIT 4 Collision Prevention and reduction-II 8 hours

Selecting and prioritizing locations for investigation, statistical analysis of accidents, in depth analysis of individual locations, defining the road accident problem, difference between site and route analysis, area wide road safety schemes, options for treating for accident problems, monitoring the effectiveness of measures and estimating accident savings and economic benefits. Importance of road markings, traffic signs and signals, traffic control devices.

UNIT 5 **Safety Audits** **8 hours**

The road safety audit procedure, and what are aims and objectives, roles and responsibility. History of road safety audit, road safety audit and design standards. Road safety audit tasks, various stages of safety audits, common identifiable problems. Structure of a road safety audit report, identity common problems, Case studies.

TextBooks:

1. Khanna S.K., Justo C.E.G., Veeraragavan A., Highway Engineering, 9/e, Nemchand and Bros, Roorkee, 2017
2. Kadiyali, L.R., Traffic Engineering and Transport Planning, 9/e, Khanna Publishers, 2018
3. Belcher, M., Proctor, S., Cook, P., Practical Road Safety Auditing,3/e, ICE Publishing, 2015

References:

1. Papacostas, C.A., Fundamentals of Transportation Engineering, 3/e, Prentice-Hall of India Private Limited, New Delhi, 2001
2. Garber, N.J., and Hoel, LA., Traffic and Highway Engineering, 5/e, Cengage learning, 2018
3. IRC SP 88: Manual on road safety Audit (2010)

Course Outcomes:

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

1. identify different types of road accidents and causes**[L3]**
2. interpret the road transport policies to prevent collisions **[L2]**
3. organize road safety audits**[L3]**
4. identify accidents hot spots and recommend corrective measure**[L3]**
5. apply the knowledge of road safety audit **[L3]**

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		2					2	2			2	2	
CO2	2	2	2	2		2			2				2	2	
CO3			2	2					2	2			2	2	
CO4		2	2	2	2								2	2	
CO5	2	2	2	2						2			2	2	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3211	SOLID AND HAZARDOUS WASTE MANAGEMENT	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The proper disposal of urban waste is not only absolutely necessary for the preservation and improvement of public health but it has an immense potential for resource recovery. From this need, the course work is structured to provide an understanding of solid and hazardous waste characteristics. This course imparts students to acquire proficiency in processing technologies and disposal methods for municipal solid waste and hazardous waste generated from a community.

Course Educational Objectives:

- to study various types of solid wastes and their characteristics
- to familiarize with different solid waste disposal techniques
- to introduce various methods of composting and influence of plastic waste on environment
- to expose to various hazardous wastes and to evaluate the possible health risks on humans and environment
- to impart various characteristics of soil pollution and to assess the controlling measures of soil pollution

UNIT 1 **8 hours**

Municipal solid waste Definition - Sources and types of solid waste- composition and its determinants of Solid waste-factors influencing generation-quantity assessment of solid wastes-methods of sampling and characterization. Collection and transfer of Municipal Solid Waste.

UNIT 2 **Disposal of Solid Wastes** **8 hours**

Refuse disposal – various methods – incineration – principle features of an incinerator – site selection and plant layout of an incinerator - sanitary landfill- methods of operation – advantages and disadvantages of sanitary land fill - site selection – reactions accruing in completed landfills – gas and leachate movement and control – equipments necessary

UNIT 3 **8 hours**

Composting: Principle – types- factors affecting compost process- mechanical composting methods. Reuse and recycling of paper, glass, rubber. Plastic waste status in India. Effect of plastic wastes on environment, management of plastic waste.

UNIT 4 **Hazardous waste Management** **8 hours**

Sources and classification of hazardous wastes – Storage and collection of hazardous wastes – Treatment and disposal techniques: Physical, chemical and biological - Protection of public health and the environment. Biomedical wastes – Types – Management and handling and control. Radioactive wastes- sources and types - control and management.

UNIT 5 **8 hours**

Soil Pollution – Physical, Chemical, Mineralogical and Biological properties of soil, sources of soil pollution, Pollution and residual toxicity from the application of insecticides, pesticides and fertilizers; Soil erosion and land degradation. Control of Soil pollution.

Text Books:

1. TechobanoglousThiesenEllasen; Solid Waste Engineering Principles and Management,Mc Graw – Hill,1997.

References

2. Manual on Municipal Solid waste Management, CPHEEO, Ministry of Urban Development, Govt. of. India, New Delhi, 2000.
3. RamanathaAyyar, T.S. " Soil Engineering in Relation to Environment " Published by LBS Centre for Science and Technology, Thiruvananthapuram, 2000
4. https://nptel.ac.in/courses/120108005/

Course Outcomes:

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

1. categories various types of solid wastes-L2
2. select an appropriate solid waste disposal technique-L2
3. differentiate different methods of composting and explain the impact of plastic waste-L3
4. evaluate hazardous waste management techniques –L4
5. summarize the impact of soil pollution on environment –L2

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 0	PO 10	PO 11	PS1 2	PS O1	PS O2	PSO 3
CO1	3	3				2	2		1			1			
CO2	3	3	2	2		2	2		1			1	2	1	
CO3	3	3	2	2		2	2		1			1	2	1	
CO4	3	3	2	2		2	2		1			1	2	1	
CO5	3	3	2	2		2	2		1			1	2	1	

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3221	Applications of GIS in Natural Resources Management	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:
To impart a sound knowledge of application of remote sensing, GIS, GPS and other tools for understanding the concepts of natural resources management, changes in environment, monitoring the pollution affected areas and would be able to prepare suitable action plans for sustainable development.

Course Educational Objectives:
- To introduce about concepts of natural resources management
- To understand RS & GIS applications in agriculture
- To understand RS & GIS applications in forest resource management
- To understand RS & GIS applications in water resource management
- To understand the concept of sustainable management

UNIT 1 Concepts of natural resources management and Land Resources Management 8 hours

Concepts of natural resources management: Types of natural resources, Mapping geological structures, Mineral resources mapping and Mineral Resources Information System.
Land Resources Management: Classification of soils and soil mapping, Land Use Land Cover Mapping, Wasteland Mapping, Soil Erosion Modelling.

UNIT 2 Agro-ecosystem management 8 hours

Crop stress detection, Thermal and Microwave RS applications, Space inputs for precision agriculture, Site suitability studies for agricultural and horticultural crops, Web-GIS applications in agriculture, FASAL scheme.

UNIT 3 Forest Resources management 8 hours

Mapping of forest cover types, Biodiversity assessment, Forest biomass estimation, forest fire risk zonation, Thermal and microwave remote sensing application in forestry, EIA of mining and Industrial activities.

UNIT 4 Water Resources Management 8 hours

Surface water resources mapping and management; Estimation and monitoring of precipitation (rainfall and snow cover), Integrated River basin management, preparation of ground water prospecting and recharging maps.

UNIT 5 Sustainable Development 8 hours

Concept of sustainability, Integrated Mission for Sustainable Development, Watershed characterization, watershed prioritization.

Text Books:

1. Introduction to Environmental Remote Sensing by Barrett E.C., Curtis, I.F., Chapman and Hall, New York, 2002

References

1. Remote Sensing principles and Interpretations- Sabins, F.F., (Ed) W.H. Freeman and Co., New York, 2006
2. Remote sensing and Image interpretation - Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc., New York, 2004.

Course Outcomes:

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

1) Explain concepts of natural resources management
2) Summarize RS & GIS applications in agriculture
3) Summarize RS & GIS applications in forest resource management
4) Summarize the RS & GIS applications in water resource management
5) Summarize the concept of sustainable management

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 0	PO 10	PO 11	PS1 2	PS O1	PS O2	PSO 3
CO1	3	3				2	2		1			1			
CO2	3	3	2	2		2	2		1			1	2	1	
CO3	3	3	2	2		2	2		1			1	2	1	
CO4	3	3	2	2		2	2		1			1	2	1	
CO5	3	3	2	2		2	2		1			1	2	1	

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3231	APPLICATIONS OF GIS IN URBAN PLANNING AND MANAGEMENT	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	CIVL1001-Basics of Geographic Information Systems						
Co-requisite	Nil						
Preferable exposure	GIS Software and analysis techniques						

Course Description:
To impart a sound knowledge of analyzing and utilizing demographic data, economic data, epidemiological data and others and use it for making spatially informed decision.

Course Educational Objectives:
- To introduce about concepts of large-scale mapping
- To understand GIS applications in transport planning
- To understand GIS applications in facility management
- To understand GIS applications in demographics and business
- To understand the concept of network analysis

UNIT 1 Large Scale Mapping (LSM) and Cadastral Information System 8 hours
Aerial Photography - High- Resolution Satellite Remote Sensing, Concept of Cadastre, Cadastral survey methods, development of cadastral information system.

UNIT 2 Transportation GIS and Cultural GIS 8 hours
Transportation GIS: vehicle routing and scheduling, optimizing routes and schedules, delivery routing, intelligent transportation system.
Cultural GIS: Mapping heritage buildings, monuments, tourism spots, recreation facilities, sports facilities and serving on web GIS.

UNIT 3 Power and Telecommunication 8 hours
Power: Site suitability assessment for power plants and impact assessment, GIS in electricity distribution network, underground cable maintenance.
Telecommunication: GIS for telecommunication, facility management in telecommunication industry, optical fiber cable alignment.

UNIT 4 Demographic and Business Applications and Business GIS 8 hours
Demographic and Business Applications: Geo-Demographics, Population distribution maps.
Business GIS: Market analysis, site selection, health care planning, financial services planning, educational institutions planning, real estate inventory, Crime Analysis.

UNIT 5 Network Applications 8 hours
Transportation network analysis, transportation planning, intelligent transportation systems, streets network analysis,
Water and sewage related- GIS based urban water demand analysis, pipeline planning and alignment.

References

1. "GIS and GPS based asset management for Road and Railway Transportation Systems "- GPS based vehicle tracking system.

www.gisdevelopment.net, www.esri.com www.aboutgis.com

Course Outcomes:

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

1) Explain concepts of large-scale mapping
2) Summarize GIS applications in transport planning
3) Summarize GIS applications in facility management
4) Summarize the GIS applications in business sector
5) Summarize the concept and application of network analysis

CO-PO Mapping:														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS1 2	PS O1	PS O2	PSO 3
CO1	3	3				2	2		1			1			3
CO2	3	3	2	2		2	2		1			1	2	1	3
CO3	3	3	2	2		2	2		1			1	2	1	3
CO4	3	3	2	2		2	2		1			1	2	1	3
CO5	3	3	2	2		2	2		1			1	2	1	3

APPROVED IN:

24-12-2021 **ACADEMIC COUNCIL: 22nd AC (01-04-2022)**

SDG No. & Statement:

SDG Justification:

CIVL3251	Construction Contracts, Finance and Valuation	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course has three main aims. The primary objective is to give students a comprehensive understanding and appreciation of Project Finance, a commonly used method for financing infrastructure projects. The course will focus on its application and usefulness across different industries, specifically in the context of Public-Private Partnerships (PPPs) in infrastructure. Additionally, the course covers concepts such as valuation, different types of construction contracts, claims, and disputes. Real-world case studies are used to illustrate the concepts and guest lectures may be utilized when relevant. The course also encourages students to present their own case studies at the end of the course.

Course Educational Objectives:

1. To familiarise the students with the concepts of infrastructure development and its funding.
2. To enable the student to understand different types of contracts used in major infrastructure projects across the globe.
3. To emphasise the project financing model of infrastructure development to equip the analysis of private financing of public infrastructure projects.
4. To enable the student to how to evaluate the existing construction assets.
5. To equip the student to understand various kinds of claims and disputes to know the solutions of various kind of construction projects so as to apply to real project analysis cases.

UNIT 1 **Introduction to Infrastructure Development** 7 hours

Introduction to infrastructure financing; Means of financing – public finance and private finance; Procurement of infrastructure projects through Public Private Partnership route – Types of PPP models, Contractual structure of PPP projects, Value for money evaluation, Lifecycle of PPP projects, PPP procurement process;

UNIT 2 **Construction Contracts** 8 hours

Standard forms of contracts used in India and abroad; Owner- construction contractor prime contract, labour agreements; purchase order and subcontract agreements; contracts, agreements, bonds, bids and proposals; contract changes - pre and post-award; delays, suspensions, and terminations; common rules of contract interpretation; Problems in the operation of contracts, Enforcement of contracts, Incentive mechanism in contracts.

UNIT 3 **Project Finance** 8 hours

Financing infrastructure projects with private capital - Introduction to project finance concept, Analysing project viability, designing security arrangements, Structuring the project, Preparing project financing plan;

UNIT 4 **Valuation of existing projects** 8 hours

Property Appraisal, Valuation and its importance, Direct Capital Valuation Method, Land and building method, Development Valuation of Properties, Income method of Valuation, Profit Method of Valuation, Investment Method of Valuation, Valuation of Residential Property, Valuation for Taxation or Rating, Valuation for Compulsory Purchase.

UNIT 5 **Construction Claims and Disputes and Student Case Studies** 8 hours

Claims and disputes, Claim process, Dispute resolutions, Arbitration settlements, Litigation on contracts, Case studies on arbitration and litigations in contracts.

Software applications in contracts and bids.

Case studies from developed and developing countries & Student presentations on various case studies

Textbooks:

Contracts

1. Various National Codes/Legislations/Standards
2. Hughes, W., Champion, R., & Murdoch, J. 2015. Construction Contracts: Law and Management (5th ed.). Oxon: Routledge.
3. D.S. Berrie and B.C. Paulson, Professional Construction Management including C.M., Design Construct And General Contracting, Third edition, McGraw Hill International edition, 1992.

Infrastructure Finance

4. Akintoye, M. Beck and C. Hardcastle, Public-Private Partnerships - Managing risks and opportunities, Oxford: Blackwell Science Limited, 2003.
5. E.R. Yescombe, Principles of Project Finance, Academic Press, 2002.

Valuation

6. Rangawala. 2015. Valuation of Real Properties Charotar Publishing House; 10th edition, 978-9385039010

References:

1. J. D. Finnerty, Project Financing - Asset-Based Financial Engineering. New York: John Wiley & Sons, Inc, 1996.
2. T. Merna and C. Njiru, Financing Infrastructure Projects, Thomas Telford, 2002.
3. P. K. Nevitt, and F. J. Fabozzi, Project Financing, Euromoney Books, 7th Ed., 2000.
4. G. Raghuram, R. Jain, S. Sinha, P. Pangotra, and S. Morris, Infrastructure Development and Financing: Towards a Public-Private Partnership, MacMillan, 2000.
5. R. Tinsley, Project Finance in Asia Pacific: Practical Case Studies, Euromoney Books, 2002.
6. UNIDO, Guidelines for Infrastructure Development through Build-Operate-Transfer (BOT) Projects, UNIDO, Vienna, 1996.
7. Walker, and A.J. Smith, Privatised Infrastructure: the Build Operate Transfer Approach, Thomas Telford, 1995.
8. L. Squire and H.G. Van der Tak, Economic Analysis of Projects, John Hopkins University Press, 1975.

Course Outcomes:

1. By the end of Unit 1, students will have a solid understanding of the concepts and methods used for funding infrastructure projects.
2. By the end of Unit 2, students will have a comprehensive understanding of project finance concepts and will be able to develop financial models for projects.
3. By the end of Unit 3, students will be able to perform accurate project valuations using standard methods.
4. By the end of Unit 4, students will be able to design or recommend appropriate contracts for specific scope of work.
5. By the end of Unit 5, students will be able to understand and apply strategies related to claims and disputes to prevent conflicts.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS12	PSO1	PSO2	PSO3
CO1	3		2			1					3				
CO2	2	3	2		3	1	3	2		2	3		3		
CO3	3	3	2			1				2	3				1
CO4	3	3	2								3				2
CO5	3	3	2	3			3	2	3	3	3	1	3	3	3

APPROVED IN:

BOS : 13-01-2023 **ACADEMIC COUNCIL: 16-05-2023**

SDG No. & Statement:

SDG Justification:

GITAM School of Technology

GITAM (Deemed to be Universtiy)

Visakhapatnam | Hyderabad | Bengaluru