



Two - Year postgraduate Programme

Master of Technology

Transportation Engineering

(Civil Department)

Faculty of Engineering & Technology

Parul University

Vadodara, Gujarat, India

Faculty of Engineering & Technology
Master of Technology in Civil Engineering

1. Vision of the Department

The vision of the Civil Engineering Program is to impart a quality engineering education and ascertain research services to mankind.

2. Mission of the Department

The mission of the Civil Engineering Department is to nurture the intellectual, professional, and personal development of our students in order to prepare and encourage them to be highly competent technocrats and responsible members of society.

3. Program Educational Objectives

The statements below indicate the career and professional achievements that the B. Tech Civil Engineering curriculum enables graduates to attain.

PEO 1	Pursue a successful career in engineering involving professional knowledge and skills for analysis, design, and solution of real-time engineering problems.
PEO 2	Excel in professional career with sound fundamental knowledge and pursue life-long learning including higher education and research.
PEO 3	To provide an environment for exploring the Research & Development attitude, to help the students in Research and Development field.

4. Program Learning Outcomes

Program Learning outcomes are statements conveying the intent of a program of study.

PLO 1	Engineering knowledge:	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PLO 2	Problem analysis:	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
PLO 3	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 public health and safety, and cultural, societal, and environmental considerations.
PLO 4	Conduct investigations of complex	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid

	problems:	conclusions.
PLO 5	Modern tool usage:	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PLO 6	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.
PLO 7	Environment and sustainability:	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
PLO 8	Ethics:	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PLO 9	Individual and team work:	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PLO 10	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.
PLO 11	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.
PLO 12	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.

5. Program Specific Learning Outcomes

PSO 1	Demand as per recent development	To embark on a career as an entrepreneur as civil engineering project manager/consultant thereby playing a very important role in society.
PSO 2	Codes for Designing	Familiarity and ability to use Indian and International Codes/ Standards for design of multidisciplinary projects.
PSO 3	Software skill	Analytical and computer skills that enable students to process information under difficult situation and to appropriately apply methods, procedures and techniques to decision making.

	203211130	Geometric Design of Highway	3	3	0	0
	203211131	Airport engineering	3	3	0	0
Elective - 2 (Compulsory Subjects: 1)						
	203211132	Urban Transportation Planning	3	3	0	0
	203211133	Economic Evaluation of Highway Project	3	3	0	0
Semester 2						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
7	203211151	Seminar & Mini Project	2	0	4	0
8	203211152	Advanced Traffic Engineering	5	3	0	2
9	203211153	Pavement Design and Evaluation	5	3	0	2
10		AUDIT-2 (Compulsory Subjects: 1)	Audit	-	-	2
11		Elective - 3 (Compulsory Subjects: 1)	3	3	0	0
12		Elective - 4 (Compulsory Subjects: 1)	3	3	0	0
		Total	18	12	4	6
AUDIT-2 (Compulsory Subjects: 1)						
	203200151	Constitution of India	Audit	-	-	2
	203200152	Pedagogy Studies	Audit	-	-	2
	203200153	Stress Management by Yoga	Audit	-	-	2
	203200154	Personality Development through Life Enlightenment Skills	Audit	-	-	2
Elective - 3 (Compulsory Subjects: 1)						
	203211180	Dock, Harbour Engineering	3	3	0	0
	203211181	Railway Infrastructure Planning & Design	3	3	0	0
Elective - 4 (Compulsory Subjects: 1)						
	203211182	Road Safety Engineering	3	3	0	0
	203211183	Intelligent Transportation System	3	3	0	0
Semester 3						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
13	203211201	Phase I Dissertation	10	0	20	0
14		Elective-5 (Compulsory Subjects: 1)	3	3	0	0
15		Open Elective (Compulsory Subjects :1)	3	3	0	0
		Total	16	6	20	0
Elective-5 (Compulsory Subjects: 1)						
	203211230	Geographical Information Systems and Remote Sensing	3	3	0	0

	203211231	Transportation Software Laboratory	3	3	0	0
Open Elective (Compulsory Subjects: 1)						
	203200201	Business Analytics	3	3	0	0
	203200202	Industrial Safety	3	3	0	0
	203200203	Operation Research	3	3	0	0
	203200204	Cost Management of Engineering Projects	3	3	0	0
	203200205	Composite Materials	3	3	0	0
	203200206	Waste to Energy	3	3	0	0
	203200207	Condition Monitoring and Reliability Assessment	3	3	0	0
Semester 4						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
16	203211251	Phase II Dissertation	16	0	32	0
		Total	16	0	32	0

8. Detailed Syllabus

Semester 1

- a. **Course Name:** Research Methodology & IPR
- b. **Course Code:** 203200101
- c. **Prerequisite:** Knowledge of Electronics and Communication Systems and Technologies. Basic Computer Skills Fundamental Knowledge of Area of Interest in relevant discipline.
- d. **Rationale:** students will learn to develop research skills
- e. **Course Learning Objective:**

CLOBJ 1	Develop a thorough understanding of various research methodologies, including qualitative, quantitative, and mixed methods, and their appropriate applications.
CLOBJ 2	Learn to formulate research questions, design research studies, and select appropriate methodologies and tools for data collection and analysis.
CLOBJ 3	Gain skills in designing robust research proposals, including hypothesis formulation, literature review, sampling methods, and data analysis techniques.
CLOBJ 4	Understand the fundamentals of intellectual property rights, including patents, copyrights, trademarks, and trade secrets.

f. Course Learning Outcomes:

CLO 1	Understand research problem formulation.
CLO 2	Analyse research related information
CLO 3	Follow research ethics
CLO 4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CLO 5	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CLO 6	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	0	0	2	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
1	Unit 1 Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.	20%	5
2	Unit 2 Effective literature studies approaches, analysis Plagiarism, Research ethics.	15%	5
3	Unit 3 Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.	15%	5
4	Unit 4 Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	20%	5
5	Unit 5 Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	15%	5
6	Unit 6 New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs..	15%	5

i. Text Book and Reference Book:

1. Writing for Science , Goldbort R; Springer
2. How to Write and Publish a Scientific Paper, Day R; Cambridge University Press
3. Handbook of Writing for the Mathematical Sciences, Highman N; SIAM. Highman's book
4. English for Writing Research Papers, Adrian Wallwork; Springer New York Dordrecht Heidelberg London,; 2011N

- a. **Course Name:** Traffic Engineering
- b. **Course Code:** 203211101
- c. **Prerequisite:** Knowledge of Transportation Engineering up to B.E./B.Tech. Level.
- d. **Rationale:** The objective of the course of Traffic Engineering is to provide safety to the road users and regulating traffic flow on the roads. It is necessary to understand the traffic flow parameters for a Traffic Engineer. Traffic Engineer should understand the basic of design of signals, intersection, capacity and level of service to provide safe, efficient and economic transportation of goods and passengers. It is important to know the methods of traffic survey and various traffic control devices. Accidents in urban area increase rapidly. It is necessary to educate the students about the prevention of accidents. The traffic engineer should know about the Environmental impact of a traffic flow and its remedial measures.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the principles and concepts of traffic engineering, including traffic flow theory, roadway design, and transportation systems management.
CLOBJ 2	Learn to apply traffic analysis techniques to evaluate and model traffic conditions, including traffic volume, speed, density, and level of service (LOS).
CLOBJ 3	Understand the key elements of roadway design, including geometric design principles, intersection design, and signalization.
CLOBJ 4	Gain knowledge about various traffic control devices, such as traffic signals, signs, and pavement markings, and their application in managing traffic flow.

f. Course Learning Outcomes:

CLO 1	Understand the basic characteristics of traffic stream
CLO 2	Conduct traffic survey and interpretation of the data.
CLO 3	Measure the Highway Capacity and Level of Service
CLO 4	Design traffic signal
CLO 5	Recognize accident and environment related terms
CLO 6	Understand merging and diverging flow

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	4	5	20	20	20	60	30	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching hours
1	Introduction Characteristics of road users; Characteristics of vehicles; Characteristics of highways, Fundamental variables of traffic flow and their interrelationship, headway - measurement techniques and analysis	15%	7
2	Traffic Surveys Volume studies; Speed studies; Travel time and Delay studies; Intersection studies, Pedestrian studies; Parking studies.	25%	12
3	Highway Capacity Analysis Highway Capacity and Level of Service; Measurement Techniques, HCM Methods, Design hourly volumes and speed, its uses	13%	6
4	Merging & Diverging Flow Merging & Diverging Flow, Weaving Flow, Length Calculations	6%	3
5	Traffic control devices Introduction about the Signs, Markings, Signal and their warrants; Signal Cycle Time Calculations, Fixed and vehicle actuated signals, Rotary	14%	7
6	Road Accidents Analysis Accident characteristics: road, driver, vehicle; Accident	14%	7

	recording and analysis; Highway safety improvement program; Safety audit		
7	Environmental Considerations Air pollution; kinds of pollutants, air pollution standards; Measures of air quality and control; Measurement of sound levels, acceptable limits; Prediction of noise levels, traffic noise control	13%	6

i. Text Book and Reference Book:

1. Kadiyali.L.R., Traffic engineering and Transport Planning
2. Introduction to Modern Traffic Flow Theory and Control, Boris S. Kerner; Springer
3. Principles of Highway Engineering and Traffic Analysis, Fred L. Mannering, Scott S. Washburn, Walter P. Kilaresh

- a. **Course Name:** Highway Materials and Construction
- b. **Course Code:** 203211102
- c. **Prerequisite:** Knowledge of Transportation Engineering up to B.E./B.Tech. Level.
- d. **Rationale:** The course provides introductory knowledge about material used in construction of highway, their properties, tests performed and methods for construction of various layers of pavement
- e. **Course Learning Objective:**

CLOBJ 1	Understand the properties, classifications, and applications of various highway materials, including asphalt, concrete, aggregates, and soil.
CLOBJ 2	Develop skills in testing and evaluating the quality of highway materials using standard laboratory methods and equipment.
CLOBJ 3	Gain knowledge of construction equipment, methods, and best practices for efficient and effective highway construction.
CLOBJ 4	Learn to interpret test results and apply quality control measures to ensure materials meet design specifications and performance standards.

f. Course Learning Outcomes:

CLO Course Learning Outcomes:	
CLO 1	Characterize the pavement materials including soil, aggregate, asphalt, cement, asphalt mixtures.
CLO 2	Choose appropriate stabilization. technique for pavement applications.
CLO 3	Determine the proportions of ingredients required for the mix design of bituminous mix.
CLO 4	Understand the importance of Highway drainage
CLO 5	Distinguish the different techniques used for construction of various pavement layers.
CLO 6	Understand the mix design methods for bituminous concrete and cement concrete.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	

3	0	4	5	20	20	20	60	30	150
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L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
1	Soil Properties, Classification, Compaction and Consolidation methods, Application and interpretation of Test Results, use of Geotextile materials.	9%	5
2	Soil Stabilization Methods, Principles, Test Significance, Design of Soil and Stabilized Mix, Quality Control tests	6%	3
3	Aggregate Aggregates Types, Tests, Desired Properties, Aggregate Blending Methods to meet specification	11%	5
4	Bituminous Materials Bituminous Materials ±Types, Laboratory Tests, Properties, interpretation of Test Results	11%	5
5	Cement Concrete Cement grades, chemical composition, testing, admixtures, fibers, properties and testing of pavement quality concrete, concrete mix design methods, high performance concrete.	9%	4
6	Mix Designs Various mix designs for Bituminous concrete and Cement concrete	22%	9
7	Highway Construction Materials and Technical specifications, Plants and equipments, construction procedure and quality control tests and their frequencies for various courses such as WMM, WBM, BM, LBM, DBM, MSS, BC, PMC and Cement concrete pavement.	27%	14
8	Highway Drainage Surface and Subsurface Drainage; design and approaches	5%	3

i. Text Book and Reference Book:

1. Highway Construction and Maintenance by Longman Scientific and Technical, J.P.Watson
2. Highway Engineering, Dr. L.R. Kadiyali; Khanna Publishers, New Delhi
3. Highway Engineering, S. K. Khanna, C.E.G. Justo
4. Highway Capacity Manual, Transportation Research Board; Washington

a. Course Name: English for Research Paper Writing

b. Course Code: 203200102

c. Prerequisite: Basic Knowledge about sentence formation using different words in present, past tenses and future time. Also, basic knowledge on use of suitable nouns, adjectives, verbs, preposition, etc.

d. Rationale: To provide a better insight for the effective use of grammar knowledge especially in writing and to put their own thoughts in to writing

e. Course Learning Objective:

CLOBJ 1	To provide a better insight for the effective use of grammar knowledge especially in writing and to put their own thoughts in to writing
CLOBJ 2	Learn to recognize and apply the standard structure of a research paper, including the abstract, introduction, literature review, methodology, results, discussion, and conclusion.
CLOBJ 3	Acquire skills in writing clear, coherent, and concise academic texts, focusing on clarity, coherence, and proper academic tone.
CLOBJ 4	Gain the ability to conduct a thorough literature review, summarizing and synthesizing relevant research to establish the context and relevance of your study.

f. Course Learning Outcomes:

CLO 1	Understand the limitations of construction techniques.
CLO 2	Implement modular construction practices.
CLO 3	Analyse various construction techniques

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	0	0	0	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
1	Unit 1 Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.	16%	5
2	Unit 2 Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts., Introduction	17%	5
3	Unit 3 Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	17%	5
4	Unit 4 Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.	17%	5
5	Unit 5 Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.	16%	5
6	Unit 6 Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.	16%	5

i. Text Book and Reference Book:

1. Writing for Science, Goldbort R; Springer
2. How to Write and Publish a Scientific Paper, Day R; Cambridge University Press
3. Handbook of Writing for the Mathematical Sciences, Highman N; SIAM. Highman's book
4. English for Writing Research Papers, Adrian Wallwork; Springer New York Dordrecht Heidelberg London,; 2011

- a. **Course Name:** Disaster Management
- b. **Course Code:** 203200103
- c. **Prerequisite:** Basics related to the disaster
- d. **Rationale:** Students will be prepared for leadership role in disaster
- e. **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding of the principles and concepts of disaster management, including preparedness, response, recovery, and mitigation.
CLOBJ 2	Gain skills in assessing and analyzing disaster risks, including hazard identification, vulnerability assessment, and risk evaluation.
CLOBJ 3	Develop the ability to coordinate disaster response efforts, including the roles and responsibilities of various agencies and organizations.
CLOBJ 4	Learn about the different types of disasters (natural, technological, and man-made) and their impacts on communities and infrastructure.
CLOBJ 5	Understand the importance of creating and maintaining disaster response protocols and communication strategies.
CLOBJ 6	Understand methodologies for mapping and analyzing potential disaster impacts on populations and infrastructure.

f. Course Learning Outcomes:

CLO 1	Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response
CLO 2	Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CLO 3	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations
CLO 4	Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

g. Teaching & Examination Scheme:

Teaching Scheme				Examination Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	0	0	0	20	20	--	60	--	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching hours
1	Introduction Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	17%	5
2	Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem, Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	17%	5
3	Disaster Prone Areas in India: Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.	17%	5
4	Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	17%	5
5	Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's, Participation in Risk Assessment. Strategies for Survival.	16%	5
6	Disaster Mitigation Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.	16%	5

i. Reference Book:

1. Disaster Management in India: Perspectives, issues and strategies by R. Nishith, Singh AK; 'New Royal book Company
2. Disaster Mitigation Experiences And Reflections by Sahni, Pardeep Et.AL. (Eds.); Prentice Hall Of India, New Delhi.
3. Disaster Administration And Management Text And Case Studies by, Goel S. L.; Deep & Deep Publication Pvt. Ltd., New Delhi.

- a. **Course Name:** Sanskrit for Technical Knowledge
- b. **Course Code:** 203200104
- c. **Prerequisite:** : basic knowledge of Sanskrit
- d. **Rationale:** Students will be able to learn Sanskrit to develop logic
- e. **Course Learning Objective:**

CLOBJ 1	To learn Sanskrit to develop the logic in mathematics, science & other subjects
CLOBJ 2	enhancing the memory power and also will help scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.
CLOBJ 3	Develop proficiency in Sanskrit technical terminology relevant to various fields of science, engineering, and technology.
CLOBJ 4	Gain a solid understanding of Sanskrit grammar and syntax, focusing on its application to technical writing and documentation.
CLOBJ 5	Develop skills in constructing and analyzing complex technical sentences and texts in Sanskrit.
CLOBJ 6	Learn to read, interpret, and analyze classical Sanskrit texts that contain technical content, such as ancient scientific manuscripts and engineering treatises.

f. Course Learning Outcomes:

CLO 1	Understanding basic Sanskrit language
CLO 2	Ancient Sanskrit literature about science & technology can be understood
CLO 3	Being a logical language will help to develop logic in students

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	0	0	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Unit 1 Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	33%	10
2	Unit 2 Order, Introduction of roots, Technical information about Sanskrit Literature	33%	10
2	Unit 3 Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	34%	10

i. Text Book and Reference Book:

1. Abhyaspustakam by Dr. Vishwas | Samskrita-Bharti Publication, New Delhi
Teach Yourself Sanskrit by Prathama Deeksha-Vempati Kutumbshastri | Rashtriya Sanskrit Sansthanam, New Delhi Publication
2. India's Glorious Scientific Tradition by Suresh Soni | Ocean books (P) Ltd., New Delhi

- a) **Course Name:** Value Education
b) **Course Code:** 203200105
c) **Prerequisite:** Nil
d) **Rationale:** to understand value of education and self- development
e) **Course Learning Objective:**

CLOBJ 1	Develop a clear understanding of core ethical and moral values such as integrity, empathy, responsibility, and respect.
CLOBJ 2	Learn to apply core values in various aspects of daily life, including personal relationships, academic settings, and professional environments.
CLOBJ 3	Explore how these values are foundational to personal development and societal well-being.
CLOBJ 4	Analyze and reflect on contemporary ethical dilemmas and moral issues from multiple perspectives.
CLOBJ 5	Understand the role of values in different cultural and social contexts, and appreciate the diversity of value systems around the world.

f) Course Learning Outcomes:

CLO 1	Knowledge of self-development
CLO 2	Learn the importance of Human values
CLO 3	Develop the overall personality

g) Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	0	0	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-**

Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Unit 1 Values and self-development: Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value	20%	8

	judgments		
2	Unit 2 Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline	27%	8
3	Unit 3 Personality and Behaviour Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.	27%	8
4	Unit 4 Character and Competence Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively	27%	8

j. Text Book and Reference Book:

1. Values and Ethics for organizations Theory and practice by Chakroborty, S.K.; Oxford University Press, New Delhi, 1999

- a. **Course Name:** Geometric Design of Highway
- b. **Course Code:** 203211130
- c. **Prerequisite:** Knowledge of Civil Engineering up to B.E./B.Tech level
- d. **Rationale:** course provides Geometric design transportation facilities, route layout and selection
- e. **Course Learning Objective:**

CLOBJ 1	Understand the principles and concepts of geometric design in highway engineering, including alignment, cross-section, and sight distance.
CLOBJ 2	Develop skills in designing horizontal and vertical alignments of highways, including curves, grades, and superelevation.
CLOBJ 3	Gain knowledge in designing various types of intersections, including at-grade intersections, interchanges, and roundabouts.
CLOBJ 4	Learn to apply geometric design principles to optimize traffic flow, safety, and accessibility at intersections.

f. Course Learning Outcomes

CLO 1	Design the longitudinal and cross sectional elements of a highway.
CLO 2	Design the intersections, interchanges
CLO 3	Design the facilities for bicyclists and pedestrians
CLO 4	Design street lighting systems
CLO 5	Design the terminal layout and design

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
1	Geometric Design: General Geometric design provisions for various transportation facilities as per AASHTO, IRC and other guidelines, Discussion of controls governing geometric design, route	15%	7

	layout and selection		
2	Elements of design Sight distances, horizontal alignment, transition curves, super $\pm$ elevation and side friction	20%	10
3	Vertical alignment Grades, crest and sag curves. Highway cross $\pm$ sectional elements and their design for rural highways, Urban streets and hill roads	20%	10
4	At grade intersections Sight distance consideration and principles of design, Channelization, mini roundabouts, layout of roundabouts, Inter $\pm$ Changes $\pm$ major and minor interchanges, entrance and exit ramps, acceleration and deceleration lanes, Bicycle and pedestrian facility design, Parking layout and design, Terminal layout and design	45%	21

i. Text Book and Reference Book:

1. Highway Construction and Maintenance by Longman Scientific and Technical J.P.Watson
2. Highway Engineering, Dr. L.R. Kadiyali; Khanna Publishers, New Delhi
3. Highway Engineering, S. K. Khanna, C.E.G. Justo
4. Highway Capacity Manual, Transportation Research Board; Washington

- a. **Course Name:** Airport engineering
- b. **Course Code:** 203211131
- c. **Prerequisite:** Knowledge of Airport Engineering up to B.E.Level.
- d. **Rationale:** Transportation contributes to the economical, industrial, social cultural development of any country. The adequacy of transportation system of a country indicates its economic social development. Airport Engineering is most important area in the field of transportation. To enable the students to study the various elements pertaining to air transportation. After studying the subject, the student will be able to understand the importance of the Air transport characteristics, Airport classification- planning, Runway Design.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the basic principles and concepts of airport engineering, including the roles and components of airport infrastructure.
CLOBJ 2	Develop skills in designing key airport components, including runways, taxiways, aprons, and terminals.
CLOBJ 3	Learn to create efficient layouts that accommodate aircraft operations, passenger flow, and cargo handling while adhering to design standards and regulations.
CLOBJ 4	Understand the factors influencing runway length, width, and alignment, as well as the design of taxiway systems and associated markings.

f. Course Learning Outcomes:

CLO 1	1. Understand the concepts of airport planning process, various Aircraft components and its function.
CLO 2	Know the Importance of Airport marking lighting of runways
CLO 3	Understand the concept of Airport, airside capacity delay, runway capacity delays, practical hourly capacity, computation of runway system, runway gate capacity, taxiway capacity
CLO 4	Understand the concepts of air traffic control
CLO 5	Forecast air traffic and know various forecasting methods
CLO 6	Understand the concepts of terminal area and airport layout

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
1	Aircraft components Parts, their function, aircraft characteristics their influence on airport planning.	5%	3
2	Airport planning Topographical geographical features, existing airport in vicinity, air traffic characteristics, development of new airports, factors affecting airport site selection	15%	7
3	Airport obstructions Zoning laws, classification of obstructions, imaginary surfaces, approach zones, turning zones	5%	3
4	Airport layout Runway orientation, wind rose diagrams, basic runway length, corrections for runway length, airport classification, geometric design, airport capacity, runway configuration, taxiway design, geometric standards, exit taxiways, holding aprons, location of terminal buildings, aircraft hangers parking.	15%	7
5	Airport marking lighting of runways, taxiway, approach other areas.	10%	5
6	Terminal area & airport layout Terminal area, planning of terminal buildings, apron: size of gate position, number of gate position, aircraft parking system, hanger, general planning considerations blast considerations	15%	7
7	Air traffic control Air traffic control aids, en-route aids, ling aids	5%	2
8	Airport drainage Requirement of airport drainage, design data, surface drainage design	10%	5
9	Airport airside capacity Airport airside capacity delay: runway capacity delays, practical hourly capacity, practical annual capacity, computation of	10%	5

	runway system, runway gate capacity, taxiway capacity		
10	Air traffic forecasting Air traffic forecasting in aviation: forecasting methods, forecasting requirement applications	10%	5

i. Text Book and Reference Book:

1. Airport Engineering, G. V. Rao; Tata Mc-Graw Hill India Publishing House
2. Airport Engineering, S.C. Rangwala
3. Airport Engineering: Planning, Design and Development of 21st Century Norman J. Ashford, Saleh Mumayiz, Paul H. Wright

- a. **Course Name:** Urban Transportation Planning
- b. **Course Code:** 203211132
- c. **Prerequisite:** Knowledge of Urban Transportation system up to B.E. Level.
- d. **Rationale:** Urban Transportation planning is most important area in the field of transportation. Looking to the present scenario, suitable transportation planning is the backbone of the urbanization. Urbanization is going on at alarming rate in developing countries like India. After studying the subject, the student will be able to understand the importance of the transportation and systematic planning in urban area. The subject covers various types of transportation systems and its characteristics. It is important to carry out thorough study of travel demand and fulfillment. The subject is useful for estimating Trip Generation, Trip Distribution, Modal Split and Trip Assignments. Land use planning models and their suitability should be studied for designing of suitable transportation systems.

e. **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding of urban transportation systems, including their components, functions, and interactions.
CLOBJ 2	Learn about different modes of transportation (e.g., road, rail, public transit, cycling) and their roles in urban mobility.
CLOBJ 3	Gain knowledge of the key processes involved in urban transportation planning, including data collection, analysis, and forecasting.
CLOBJ 4	Learn to use models and simulation tools to predict traffic patterns, congestion, and travel demand.

f. **Course Learning Outcomes:**

CLO 1	Understand the concepts of Transportation planning process, various modes, transit systems and their suitability.
CLO 2	Apply sequential travel demand forecasting process
CLO 3	Understand the concept land use planning
CLO 4	Know the concepts of BRTS, Metro
CLO 5	Carry out transportation surveys
CLO 6	Understand the concept of urban goods movement

g. **Teaching & Examination Scheme:**

g. Teaching & Examination Scheme:									
Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
1	Introduction Introduction to transportation systems planning based on systems approach, various modes of transportation and comparisons, urban transportation system planning process	13%	7
2	Transportation surveys Transportation surveys, O-D survey, methodology and analysis	9%	5
3	Urban Mass transportation Systems Urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, including BRTS, Metro	13%	6
4	Travel demand modeling Trip generation, trip distribution, modal split analysis, trip assignment techniques, and various models, transportation impact study	41%	18
5	Land use planning models Land use planning models and their suitability, Transportation impacts study methodologies	15%	6
6	Urban goods movement Urban goods movement, framework and case studies	9%	5

i. Text Book and Reference Book:

1. Traffic Engineering and Transportation Planning, L.R. Kadiyali; Khanna Publishers
2. Principles of Transportation Engineering, Partho Chakraborty and Animesh Das
3. Metropolitan Transportation Planning, W.Dickey
4. Cities of Tomorrow: An Intellectual History of Urban Planning and Design Since 1880', Peter Hall; Wiley-Blackwell

- a. **Course Name:** Economic Evaluation of Highway Project
- b. **Course Code:** 203211133
- c. **Prerequisite:** Knowledge of Transportation Engineering.
- d. **Rationale:** Students will be able to economically evaluate all types of highway projects
- e. **Course Learning Objective:**

CLOBJ 1	Develop a foundational understanding of the principles and methodologies used in the economic evaluation of highway projects, including cost-benefit analysis (CBA), cost-effectiveness analysis, and economic impact assessment.
CLOBJ 2	Gain proficiency in estimating and analyzing the costs associated with highway projects, including construction, maintenance, and operational costs.
CLOBJ 3	Learn to identify and quantify the benefits of highway projects, including travel time savings, vehicle operating cost reductions, safety improvements, and environmental impacts.
CLOBJ 4	Acquire skills in collecting and analyzing data relevant to economic evaluation, including traffic data, user surveys, and economic indicators.

f. Course Learning Outcomes:

CLO 1	Learn about highway projects
CLO 2	Evaluation of highway constructions
CLO 3	Estimation of highway projects
CLO 4	Economic consideration for highway construction
CLO 5	Programming for project management
CLO 6	Apply the concepts for practical highway projects

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
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1	Economic Evaluation of Transport Projects Need for economic evaluation, Cost and benefits of transport projects, Time horizon in economic assessment, Basic principles of economic evaluation, interest rate, method of economic evaluation, benefit cost ratio method, first year rate of return, net present value method , internal rate of return method, Comparison of various methods of economic evaluation	30%	14
2	Vehicle Operating Costs Introduction, Road used cost study in India, Components of VOC, and factors affecting VOC, Fuel consumption relationship, Spare parts, Maintenance and repairs, labour cost, tyre life, lubricants, utilization and fixed costs.	20%	10
3	Value of Travel Time Savings Introduction, Classes of transport users enjoying travel time savings, Methodology for monetary evaluation of passengers, travel time, Review of work in India on passengers travel time. Accidents Costs: Introduction, Relevance of accident costing for a developing country, Review of alternative methodologies for accident costing, Indian studies. Traffic Congestion: Main causes of traffic congestion, mechanisms to deal with traffic congestion congestion pricing, road space rationing, capacity expansion.	25%	12
4	Funding and Financing of Transportation Projects Methods for raising funds for maintenance, improvement and expansion of transportation networks, taxation and user fee, financing through loans, bonds, PPPs and concessions, Highway financing in India	15%	7
5	Case Study A typical case study of economic evaluation of Highway Project	10%	5

i. Text Book and Reference Book:

1. Manual on Economic Evaluation of Highways in India, IRC-SP: 30 (2009); Indian Roads Congress
2. Principles of Transportation Engineering, Partho Chakraborty and Animesh Das
3. Principles of Transportation and Highway Engineering, G.V.Rao; Tata McGraw-Hill Publishing

Semester 2

- a. **Course Name:** Advanced Traffic Engineering
- b. **Course Code:** 203211152
- c. **Prerequisite:** Knowledge of Traffic Engineering.
- d. **Rationale:** The course provides advanced knowledge of the field of Traffic Engineering to the students.
- e. **Course Learning Objective:**

CLOBJ 1	The course provides advanced knowledge of the field of Traffic Engineering to the students.
CLOBJ 2	Understand and apply advanced theories and models of traffic flow and queuing, including nonlinear and stochastic models, to analyze and predict traffic behavior under varying conditions.
CLOBJ 3	Evaluate and design sophisticated traffic control systems, including adaptive signal control, intelligent transportation systems (ITS), and advanced driver assistance systems (ADAS), to optimize traffic flow and enhance safety.
CLOBJ 4	Critically assess and design complex transportation infrastructure projects, including highways, intersections, and urban road networks, ensuring they meet operational, safety, and environmental standards.

f. Course Learning Outcomes:

CLO 1	Develop traffic stream models
CLO 2	Analyze capacity of highways
CLO 3	Design coordinated traffic signals along a corridor
CLO 4	Estimate traffic flow parameters
CLO 5	Simulate traffic at mid blocks and intersections
CLO 6	Apply queuing theory for transportation engineering

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	2	5	20	20	20	60	30	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
1	Basic Traffic Flow Parameters - General Speed-Flow, Speed-Density, Flow-Density Curves and relations & their Models	8%	4
2	Speed-Flow on Grades HCM Methods, Design hourly volumes and speed; Highway capacity and performance characteristics	8%	4
3	Traffic Flow Characteristics Traffic Flow characterization, Categories of Traffic Flow, Macroscopic and Microscopic Traffic Flow Models, Vehicular Stream Models, Lighthill and Withams Theory, Application of theory to deal bottlenecks-Trajectory Diagrams, Shock waves	30%	14
4	Intersection Design Design of Intersection, At grade intersection, Uncontrolled, Channelization, Rotary, Traffic Signal Control, Signal Co-ordination, Grade Separated Intersection-Types and Design	17%	8
5	Design Of Transport Infrastructure Design of Cycle Tracks, Pedestrian Facilities, Parking Facilities On Street, Off Street Multi level Street Lighting	10%	5
6	Traffic Management Traffic Systems Management and Travel Demand Management - Congestion Management, Traffic Calming and Pricing	6%	3
7	Queuing Analysis Queuing Theory, Types of Queuing Model, Queuing Characteristics and Behaviour, Transition Diagram, Queuing Cost Model Application to Traffic Engineering	13%	6
8	Traffic Simulation Use of VISSIM and VISUM simulation in solving traffic related problems. Exposure of TransCAD and CUBE software	8%	4

i. Text Book and Reference Book:

1. Kadiyali.L.R., Traffic engineering and Transport Planning
2. Introduction to Modern Traffic Flow Theory and Control, Boris S. Kerner; Springer

- a. **Course Name:** Pavement Design and Evaluation
- b. **Course Code:** 203211153
- c. **Prerequisite:** Core course
- d. **Rationale:** Knowledge of Highway Materials and Construction.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the properties and behavior of various pavement materials, including asphalt, concrete, and alternative materials, and how these properties influence pavement performance and durability.
CLOBJ 2	Apply advanced pavement design methodologies and criteria, including those based on mechanistic-empirical approaches and performance-based design, to create effective and sustainable pavement structures.
CLOBJ 3	Utilize analytical tools and models to assess the structural capacity of existing pavements and predict their performance under different loading and environmental conditions.
CLOBJ 4	Design and apply methods for monitoring and evaluating pavement performance, including the use of condition assessment tools and techniques to identify distress and deterioration.

f. Course Learning Outcomes:

CLO 1	Compare Highway & Airport pavement
CLO 2	Compare Flexible and Rigid pavement
CLO 3	Apply various methods of flexible pavement design
CLO 4	Apply various methods of rigid pavement design
CLO 5	Understand concepts of highway pavement maintenance
CLO 6	Learn various concepts of pavement evaluation

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	2	5	20	20	20	60	30	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching hours
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1	General Types, Highway-Runway Comparison	4%	2
2	Design of Flexible Pavements Factors affecting design and performance - Stresses and deflection in homogenous masses, Burmister's 2 layer, 3 layer and multi-layer theories , wheel load stresses, ESWL, CBR method, principle, advantages and application, testing as per IRC, AASHTO, and asphalt institute, problems on above	46%	22
3	Design of Rigid Pavements Factors affecting design and performance, types of stresses, causes and factors affecting stresses, EWL, Westerguard's analysis, Bradbury's coefficient, wheel load stresses, warping-frictional combined stresses, IRC design chart, design of longitudinal contraction and expansion joints, and design of slabs	29%	14
4	Pavement Evaluation and Maintenance Failures in pavements, methods of measurement of skid resistance, unevenness, ruts and cracks, Pavement surface condition evaluation by physical measurements methods and their application, serviceability rating techniques, maintenance strategies evaluation by non-destructive tests-Benkelman beam method, overlay design	21%	10

i. Text Book and Reference Book:

1. Kadiyali.L.R., Traffic engineering and Transport Planning

- a. **Course Name:** Dock, Harbour Engineering
- b. **Course Code:** 203211180
- c. **Prerequisite:** Elective course
- d. **Rationale:** Get the knowledge about the planning and designing of dock and harbour
- e. **Course Learning Objective:**

CLOBJ 1	Get the knowledge about the planning and designing of dock and harbour
CLOBJ 2	Comprehend the basic principles of dock and harbour engineering, including the key components, structures, and functions of ports and docking facilities.
CLOBJ 3	Apply engineering concepts to design efficient and sustainable dock and harbour structures, considering factors such as hydrodynamics, environmental impact, and operational requirements.
CLOBJ 4	Demonstrate knowledge of construction techniques, materials, and maintenance practices relevant to docks and harbours, ensuring the longevity and safety of the infrastructure.

f. Course Learning Outcomes:

CLO 1	Plan and design harbour facilities
CLO 2	Estimate Traffic demand for harbour planning
CLO 3	Discriminate harbour works, berthing structures and transit sheds
CLO 4	Understand repair facilities, port facilities and cargo handling facilities required
CLO 5	Design coastal protection facilities
CLO 6	Understand navigational aids and inland navigation for safe operations

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
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1	General Introduction to water transportation, History, development and policy, classification of Harbours, Docks and Ports, major Ports in India, administrative set up	8%	4
2	Planning & Design of Harbour Harbour components & its functions, ship features & ship characteristics, Tonnage relations, Ships for LPG, LNG and other Bulk Cargo, Desirable features of Harbour site, Coastal structures, Coastal Environments, wind, waves, tides & currents observations, principles of Harbour planning & layouts design considerations. Site investigation ± Hydrographic survey, Topographic survey, Geological & Geo-technical studies.	19%	9
3	Coastal structures General design aspects, construction features of Breakwaters, Piers, Wharves, Dolphin, Fender system, Moles, Trestles Mooring accessories, Berth & Slip dimensions, width of Apron, Estimation of required number of Berths, General cargo Berth, Tanker Berth, Explosive Berth & fire protection.	19%	9
4	Navigation Aids Necessity of Navigational aids, Types of Visual, Lights, Signals, Aural & electronic aids, floating & fixed aids, Range light installation, Light house & Light ship.	15%	7
5	Dredging and Coastal Protection Classification of Dredgers, choice of Dredgers, used of dredged materials, coastal erosion and protection	8%	4
6	Docks and Repair Facilities Use of wet docks and design of wet docks, repair docks, lift docks, dry docks, Floating docks, Slipway keel and bilge blocking, construction of dry docks, gates & locks.	10%	5
7	Port Amenities Primary, secondary & Auxiliary Port-function. Port-planning & Port developments, Terminal building, Cargo handling equipment on land side and within ship, selection of cargo handling equipment for general cargo, container type cargo and bulk cargo, storage facilities & cold storage, Land transportation facilities for collection & distribution of commodities.	13%	6
8	Ro-Ro Ferry Services Roll on Roll off concept, factors affecting Ro-Ro Ferry service, Evaluation of Ro-Ro Ferry service, Facilities at Mumbai, Hover	8%	4

	craft, Hydrofoil Boats, Multi-hull ship.		
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i. Text Book and Reference Book:

1. A Course in Docks and Harbour Engineering, S. P. Bindra; Dhanpat Rai & Sons
2. Harbour, Docks and Tunnel Engineering, R. Srinivasan
3. Dock and Harbour Engineering, S. Seetharaman; Umesh Publications

- a. **Course Name:** Railway Infrastructure Planning & Design
- b. **Course Code:** 203211181
- c. **Prerequisite:** Elective
- d. **Rationale:** Enable to plan and design the different components of railway engineering
- e. **Course Learning Objective:**

CLOBJ 1	Identify and describe the key components of railway infrastructure, including tracks, stations, signaling systems, and maintenance facilities.
CLOBJ 2	Use planning principles to design efficient and effective railway networks that address operational needs, safety standards, and future expansion considerations.
CLOBJ 3	Develop comprehensive designs for railway infrastructure, including track alignment, station layout, and signaling systems, considering factors such as topography, traffic demand, and environmental impact.
CLOBJ 4	Perform feasibility studies and cost-benefit analyses for railway projects, evaluating factors like economic viability, environmental impact, and social implications.

f. Course Learning Outcomes:

CLO 1	Apply track design principles, components and design criteria
CLO 2	Design and analyse the railway track system and signal system with the available methods
CLO 3	Maintain the railway track and apply remedial measures
CLO 4	Execute the minor and major projects related to railway infrastructure
CLO 5	Design railway network, routes and schedules.
CLO 6	Design of infrastructure required for railways

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
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1	Permanent Way: Requirements, capacity, cross-sections, forces acting on the track, coning of wheels, tilting of rails, function of rails, types of rails, rail wear, defects in rails, creep of rails, rail fixtures and fastenings, ballast, functions, types, sizes, physical properties, subgrade and formation, slopes of formation, switches, tongue rails, crossing, angle of crossing, turnouts, inspection and maintenance, track junctions and track layouts, symmetrical split, three-throw switch, double turnout, diamond crossing, scissors crossover, gauntleted track, gathering line, triangle, double junctions	27%	13
2	Geometric Design: Geometric design, gradients, grade compensation, speeds of trains, curves and superelevation, extra clearance on curves, widening of gauge on curves, cutting rails on curves.	21%	10
3	Railway stations and yards: Purpose, site selection, facilities, requirements, classification, platforms, building areas, types of yards, catch sidings, ship sidings, foot over bridges, subways, cranes, weigh bridge, loading gauge, end loading ramps, locomotive sheds, ash-pits, water columns, turntable, triangles, traverser, carriage washing platforms, buffer stop, scotch block, derailing switch, sand hump, fouling mark.	16%	7
4	Signaling and interlocking: Objectives, classification, fixed signals, stop signals, signaling systems, mechanical signaling system, electrical signaling system, systems for controlling train movement, interlocking, modern signaling installations.	12%	6
5	Track maintenance and Rehabilitation: Maintenance tools, maintenance of rail surface, track drainage, maintenance in track circuited lengths, track tolerances, mechanized method of track maintenance, off-track tampers, shovel packing, directed track maintenance, classification of renewal works, through sleeper renewals, mechanized relaying, track renewal trains	12%	6
6	Modernization in Railways: Modernization of railways, effect of high speed track, vehicle performance on track, high speed ground transportation system, ballastless track, elevated railways, underground and tube railways, MAGLEV trains.	12%	6

i. Text Book and Reference Book:

1. A text book of Railway Engineering (TextBook), S.C. Saxena and S.P. Arora
2. A textbook of Railway Engineering, S.C. Rangwala
3. Text Book of Railway Engineering, B.L. Gupta

- a. **Course Name:** Road Safety Engineering
- b. **Course Code:** 203211182
- c. **Prerequisite:** ELECTIVE
- d. **Rationale:** Knowledge regarding the road safety and repairing by conducting the audit
- e. **Course Learning Objective:**

CLOBJ 1	Explain the core principles of road safety engineering, including the factors contributing to road accidents and the role of engineering in mitigating these factors.
CLOBJ 2	Use statistical tools and methodologies to analyze traffic accident data, identify patterns, and assess risk factors to inform safety improvements.
CLOBJ 3	Apply engineering principles to design roadways and traffic control devices (e.g., signs, signals, markings) that enhance safety and reduce accident risks for all road users.
CLOBJ 4	Assess the effectiveness of existing road safety measures and interventions, such as speed limits, road geometry, and pedestrian facilities, and recommend improvements based on empirical evidence.

f. Course Learning Outcomes:

CLO 1	Analyze the effect of driver characteristics, roadway characteristics, climatic factors on highway safety.
CLO 2	Analyze accident data and suggest safety measures
CLO 3	Interpret accident data using statistical analysis.
CLO 4	Plan and design a road safety improvement program
CLO 5	Conduct road safety audit
CLO 6	Understand the concepts of crash reconstruction.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching
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			hours
1	Introduction to safety: Road accidents, Trends, causes, Collision and Condition diagrams, Highway safety, human factors, Vehicle factors, IRC Road accident forms	10%	5
2	Road Safety Management System: Multi-causal dynamic systems approach to safety, crash vs accident, road safety improvement strategies, elements of a road safety plan, Safety Data Needs.	25%	16
3	Statistical Interpretation and Analysis of Crash Data: Before-after methods in crash analysis, Advanced statistical methods, Black Spot Identification & Investigations	20%	13
4	Road Safety Audits: Key elements of a road safety audit, Road Safety Audits & Investigations, Crash investigation and analysis, Describe methods for identifying hazardous road locations, Case Studies.	15%	10
5	Crash Reconstruction: Describe the basic information that can be obtained from the roadway surface, Understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies.	15%	10
6	Mitigation Measures: Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety.	15%	10

i. Text Book and Reference Book:

1. Traffic Safety by Leonard Evans, Science Serving Society
2. The Traffic Safety Toolbox: A Primer on Traffic Safety, Institute of Transportation Engineers (ITE)

- a. **Course Name:** Intelligent Transportation System
- b. **Course Code:** 203211183
- c. **Prerequisite:** ELECTIVE
- d. **Rationale:** Knowledge regarding ITS System
- e. **Course Learning Objective:**

CLOBJ 1	Emphasizes the ability to critically evaluate and create ITS solutions.
CLOBJ 2	Focuses on incorporating various technological components within ITS.
CLOBJ 3	Highlights the importance of assessing the effects of ITS on different aspects of transportation.
CLOBJ 4	Ensures students are familiar with key ITS components like sensors, communication systems, and data management tools.

f. Course Learning Outcomes:

CLO 1	Manage traffic with the help of sophisticated information system
CLO 2	Plan mass transportation system
CLO 3	use information technology to solve traffic related problems.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
1	Introduction Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection	10%	5

2	Telecommunications in ITS Importance of telecommunications in the ITS system. Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System	20%	10
3	ITS functional areas Advanced Traffic Management Systems (ATMS) Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).	30%	14
4	ITS User Needs and Services Travel and Traffic management. Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management	25%	12
5	Automated Highway Systems Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World– Overview of ITS implementations in developed countries, ITS in developing countries.	15%	7

i. Text Book and Reference Book:

1. Kadiyali.L.R., Traffic engineering and Transport Planning
2. Highway Capacity Manual, Transportation Research Board; Washington
3. Advanced Technologies for Intelligent Transportation Systems, Picone, M., Busanelli, S., Amoretti, M., Zanichelli, F., Ferrari, G.-L.; Springer, 2014