**COURSE DELIVERY PLAN**

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| **DEPARTMENT OF CIVIL ENGINEERING** | **T** | :0 |
| **COURSE** | : CE | **P** | :0 |
| **REGULATION** | : R-20 (R2021015) | **C** | :3 |
| **COURSE CODE** | : 20CE2C6 | **Date** | : |
| **COURSE NAME** | : HIGHWAY ENGINEERING | **Rev. No** | : |
|  |
| **CLASS** | **COURSE COORDINATOR** | **SECTION** | **NAME OF THE FACULTY** |
| II B. Tech- I Sem | Y,PRIYANKA | CE-A |  |

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| **COURSE OUTCOMES:** |
| After successful completion of the course, the student will be able to- |
| **CO-1** | **Impart** different concepts in the field of Highway Engineering. |
| **CO-2** | **Acquire** design principles of Highway Geometrics and Pavements |
| **CO-3** | **Acquire** design principles of Intersections |
| **CO-4** | **Determine** Highway alignment and design highway geometrics |
| **CO-5** | **Design** Intersections and prepare traffic management plans |

Bridge Course:

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| **S No.** | **Topic Discussed** |
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|  **UNIT – I Highway Planning and Alignment:** Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans, First, second, third road development plans, road development vision 2021, Rural Road Development Plan, Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys, Drawings and Reports.  |
| **OBJECTIVE:**The students are to be able to plan a highway network analyze the propped cantilevers and fixed beams.  |
| **Session No.** | **Topics to be Covered** | **Reference** | **Teaching Aids/ Class Methods** |
| **1.** | Introduction to Highway development in India | T1, Page-65 | PPT |
| **2.** | Classification of Roads | T1, Page-66 | Chalk & Talk |
| **3.** | Road Network Patterns | T1, Page-67 | Chalk & Talk |
| **4.** | Necessity for Highway Planning | T1, Page-68 | Chalk & Talk |
| **5.** | Different Road Development Plans | T1, Page-69 | Chalk & Talk |
| **6.** | First, second, third road development plans | T1, Page-70 | Chalk & Talk |
| **7.** | road development vision 2021 | T1, Page-71 | Chalk & Talk |
| **8.** | Rural Road Development Plan | T1, Page-72 | Chalk & Talk |
| **9.** | Vision 2025 | T1, Page-73 | Chalk & Talk |
| **10.** | Planning Surveys | T1, Page-74 | Chalk & Talk |
| **11.** | Highway Alignment | T1, Page-75 | Chalk & Talk |
| **12.** | Factors affecting Alignment | T1, Page-76 | Chalk & Talk |
| **13.** | Engineering Surveys | T1, Page-77 | Chalk & Talk |
| **14.** | Drawings and Reports | T1, Page-75 | Chalk & Talk |
| Content beyond syllabus covered (if any)1.2. |

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| **UNIT -II Highway Geometric Design**: Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment-Design of Super elevation and Extra widening- Design of Transition Curves- Design of Vertical alignment Gradients- Vertical curves |
| **OBJECTIVE:**The students are to be able to design highway elements like super elevation alignment. |
| **Session No.** | **Topics to be Covered** | **Reference** | **Teaching Aids/ Class Methods** |
| **15.** | Introduction to Highway Geometric Design | T-1, Page-114 | PPT |
| **16.** | Importance of Geometric Design | T-1, Page-115 | Chalk & Talk |
| **17.** | Design controls and Criteria | T-1, Page-116 | Chalk & Talk |
| **18.** | Highway Cross Section Elements | T-1, Page-117 | Chalk & Talk |
| **19.** | Problems on highway design | T-1, Page-120 | Chalk & Talk |
| **20.** | Sight Distance Elements | T-1, Page-121-124 | Chalk & Talk |
| **21.** | Problems on sight distance | T-1, Page-125-128 | Chalk & Talk |
| **22.** | Stopping sight Distance | T-1, Page-129-130 | Chalk & Talk |
| **23.** | Problems on Stopping sight Distance | T-1, Page-131-134 | Chalk & Talk |
| **24.** | Overtaking Sight Distance and Intermediate Sight Distance | T-1, Page-135-136 | Chalk & Talk |
| **25.** | Problems on Overtaking Sight Distance and Intermediate Sight Distance | T-1, Page-137 | Chalk & Talk |
| **26.** | Design of Horizontal Alignment | T-1, Page-138 | Chalk & Talk |
| **27.** | Problems on Design of Horizontal Alignment | T-1, Page-141 | Chalk & Talk |
| **28.** | Design of Horizontal Alignment | T-1, Page-142 | Chalk & Talk |
| **29.** | Design of Super elevation and Extra widening | T-1, Page-143 | Chalk & Talk |
| **30.** | Problems on Design of Super elevation and Extra widening | T-1, Page-144 | Chalk & Talk |
| **31.** | Design of Transition Curves | T-1, Page-145 | Chalk & Talk |
| **32.** | Problems on Transition Curves | T-1, Page-146 | Chalk & Talk |
| **33.** | Design of Vertical alignment Gradients | T-1, Page-147 | Chalk & Talk |
| **34.** | Problems on Design of Vertical alignment Gradients | T-1, Page-148 | Chalk & Talk |
| **35.** | Vertical Curves | T-1, Page-149 | Chalk & Talk |
| **36.** | Problems on Vertical Curves | T-1, Page-150 | Chalk & Talk |
| Content beyond syllabus covered (if any)1.2. |

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| **UNIT -III Traffic Engineering:** Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies, spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways , Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections, Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals, Webster Method, IRC Method. |
| **OBJECTIVE:**The students are to be analyze forces in member by using different methods |
| **Session No.** | **Topics to be Covered** | **Reference** | **Teaching Aids/ Class Methods** |
| **37.** | Introduction to Traffic Engineering | T-1, Page-308 | PPT |
| **38.** | Basic Parameters of Traffic-Volume | T-1, Page-309 | Chalk & Talk |
| **39.** | Speed and Density | T-1, Page-310 | Chalk & Talk |
| **40.** | Traffic Volume Studies | T-1, Page-311 | Chalk & Talk |
| **41.** | Speed studies, spot speed and speed & delay studies | T-1, Page-312 | Chalk & Talk |
| **42.** | Parking Studies; Road Accidents | T-1, Page-313 | Chalk & Talk |
| **43.** | Causes and Preventive measures | T-1, Page-314 | Chalk & Talk |
| **44.** | Condition Diagram and Collision Diagrams | T-2, Page-208 | Chalk & Talk |
| **45.** | PCU Factors | T-2, Page-209 | Chalk & Talk |
| **46.** | Capacity of Highways | T-2, Page-210 | Chalk & Talk |
| **47.** | Factors Affecting; LOS Concepts | T-2, Page-211 | Chalk & Talk |
| **48.** | Road Traffic Signs | T-2, Page-212 | Chalk & Talk |
| **49.** | Road markings | T-2, Page-213 | Chalk & Talk |
| **50.** | Types of Intersections | T-2, Page-214 | Chalk & Talk |
| **51.** | At-Grade Intersections | T-2, Page-215 | Chalk & Talk |
| **52.** | Design of Plain, Flared, Rotary and Channelized Intersections | T-2, Page-216-217 | Chalk & Talk |
| **53.** | Problems on Channelized Intersections  | T-2, Page-218 | Chalk & Talk |
| **54.** | Design of Traffic Signals | T-2, Page-219 | Chalk & Talk |
| **55.** | Webster Method | T-2, Page-220 | Chalk & Talk |
| **56.** | Problems on Webster Method  | T-2, Page-221 | Chalk & Talk |
| **57.** | IRC Method | T-2, Page-222 | Chalk & Talk |
| **58.** | Problems on IRC Method | T-2, Page-223 | Chalk & Talk |
| Content beyond syllabus covered (if any)1.2. |

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| **UNIT -IV Highway Materials:** Subgrade soil: classification, Group Index, Subgrade soil strength, California Bearing Ratio, Modulus of Subgrade Reaction. Stone aggregates: Desirable properties, Tests for Road Aggregates, Bituminous Materials: Types, Desirable properties, Tests on Bituminous paving mixes: Requirements, Marshall method of mix design |
| **OBJECTIVE:**The students are to be able to analyze and draw the influence line diagrams for various types of moving loads on beams and bridges. |
| **Session No.** | **Topics to be Covered** | **Reference** | **Teaching Aids/ Class Methods** |
| **59.** | Introduction to Highway Materials | T-2, Page-241 | PPT |
| **60.** | Subgrade soil: classification | T-2, Page-242 | Chalk & Talk |
| **61.** | Group Index | T-2, Page-243 | Chalk & Talk |
| **62.** | Subgrade soil strength | T-2, Page-244 | Chalk & Talk |
| **63.** | California Bearing Ratio | T-2, Page-245 | Chalk & Talk |
| **64.** | Modulus of Subgrade Reaction | T-2, Page-246 | Chalk & Talk |
| **65.** | Stone aggregates | T-2, Page-247 | Chalk & Talk |
| **66.** | Desirable properties | T-2, Page-248 | Chalk & Talk |
| **67.** | Tests on Bituminous paving mixes- Requirements | T-2, Page-249 | Chalk & Talk |
| **68.** | Marshall method of mix design | T-2, Page-250 | Chalk & Talk |
| Content beyond syllabus covered (if any)1.2. |

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| **UNIT -V Design of Pavements:** Types of pavements; Functions and requirements of different components of pavements; Design Factors Flexible Pavements: Design factors, Flexible Pavement Design Methods, CBR method, IRC method, Burmister method, Mechanistic method, IRC Method for Low volume Flexible pavements. Rigid Pavements: Design Considerations, wheel load stresses, Temperature stresses, Frictional stresses, Combination of stresses, Design of slabs, Design of Joints, IRC method, Rigid pavements for low volume roads, Continuously Reinforced Cement Concrete Pavements, Roller Compacted Concrete Pavements. |
| **OBJECTIVE:**The students are to be able to analyze continuous beams and frames using different matrix methods. |
| **Session No.** | **Topics to be Covered** | **Reference** | **Teaching Aids/ Class Methods** |
| **69.** | Introduction to Pavements | T-1, Page-308 | PPT |
| **70.** | Types of pavements | T-1, Page-309 | Chalk & Talk |
| **71.** | Functions and requirements of different components of pavements | T-1, Page-310 | Chalk & Talk |
| **72.** | Design Factors Flexible Pavements | T-1, Page-311 | Chalk & Talk |
| **73.** | Design factors, Flexible Pavement Design Methods | T-1, Page-312 | Chalk & Talk |
| **74.** | CBR method, IRC method | T-1, Page-313 | Chalk & Talk |
| **75.** | Burmister method, Mechanistic method | T-1, Page-314 | Chalk & Talk |
| **76.** | IRC Method for Low volume Flexible pavements | T-1, Page-315 | Chalk & Talk |
| **77.** | Problems on flexible pavement design | T-1, Page-316 | Chalk & Talk |
| **78.** | Rigid Pavements: Design Considerations, wheel load stresses | T-1, Page-317 | Chalk & Talk |
| **79.** | Temperature stresses, Frictional stresses, Combination of stresses | T-1, Page-318-320 | Chalk & Talk |
| **80.** | Problems on Rigid Pavements, Design of slabs | T-1, Page-321 | Chalk & Talk |
| **81.** | Problem on slab design, Design of Joints | T-1, Page-322 | Chalk & Talk |
| **82.** | Problems on Joints, IRC method | T-1, Page-323 | Chalk & Talk |
| Content beyond syllabus covered (if any)1.2. |

Session Duration: 50 Minutes

Total No. of Sessions Required: 82

**COURSE OUTCOMES:**

Student must be able to:

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| **CO-1** | **Impart** different concepts in the field of Highway Engineering. | **Analyze** | **K4** |
| **CO-2** | **Acquire** design principles of Highway Geometrics and Pavements | **Analyze** | **K4** |
| **CO-3** | **Acquire** design principles of Intersections | **Analyze** | **K4** |
| **CO-4** | **Determine** Highway alignment and design highway geometrics | **Analyze** | **K4** |
| **CO-5** | **Design** Intersections and prepare traffic management plans | **Analyze** | **K4** |

**PROGRAM OUTCOMES:**

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| S No. | Graduate Attributes | Action Verbs | Level |
| 1. | Engineering Knowledge | Action Verbs | Level |
| 2. | Problem Analysis | APPLY, ANALYZE | K3,K4 |
| 3. | Design Development of Solutions | ANALYZE | K4 |
| 4. | Investigation of Complex Problems | EVALUATE | K5 |
| 5. | Modern Tool Usage | APPLY, ANALYZE, EVALUATE | K3,K4,K5 |
| 6. | Engineer and Society | EVALUATE | K5 |
| 7. | Environment and Sustainability |  |  |
| 8. | Ethics |  |  |
| 9. | Individuals and Team Work |  |  |
| 10. | Communication | ANALYZE | K3 |
| 11.  | Life Long Learning |  |  |
| 12. | Project Management and Finance | APPLY | K3 |
|  |  | CREATE | K6 |

**PROGRAM SPECIFIC OUTCOMES:**

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| **PSO1** | Carry out projects in the field of real estate and infrastructural engineering. |
| **PSO2** | Provide solution for environmental and social issues through sustainable approach. |

**MAPPING OF CO-PO-PSO:**

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

1. **Weekly Mapped 2. Mapped 3. Strongly Mapped**

**REFERENCES:**

**TEXT BOOKS:**

1. Highway Engineering, Khanna S. K., Justo C. E. G and Veeraragavan A, Nem Chand Bros., Roorkee.

 2. Traffic Engineering and Transportation Planning, Kadiyali L. R, Khanna Publishers, New Delhi

**REFERENCES:**

1. Principles of Highway Engineering, Kadiyali L. R, Khanna Publishers, New Delhi

2. Principles of Transportation Engineering, Partha Chakroborthy and Animesh Das, PHI Learning Private limited new Delhi.

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| **Prepared By** | **Signatures** | **Approved By** | **Signature** |
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