

|                            |   |                       |         |
|----------------------------|---|-----------------------|---------|
| Course Title               | <b>PAVEMENT CONSTRUCTION<br/>TECHNOLOGY</b> | Semester              | III     |
| Course Code                | MVJ19CTE31                                  | <b>CIE</b>            | 50      |
| Total No. of Contact Hours | 60 L : T : P :: 40: 0 : 20                  | <b>SEE</b>            | 50      |
| No. of Contact Hours/week  | 4   | <b>Total</b>          | 100     |
| <b>Credits</b>             | 4   | <b>Exam. Duration</b> | 3 Hours |

**Course objective is to:**

- Explain concept of location surveys, procedure of preparing project report, documentation of contract.
- Explain features, functioning and uses of different types of equipment's used in road construction and construction specification for different layers of road
- Provide information on specifications of construction of different types of granular subbase, base and surface course and construction of special pavement
- Provide information on application of CPM and PERT in construction planning
- Explain the maintenance activities for road and road furniture

**Module-1**

**L3**

**12 Hrs.**

Road infrastructure development process: Importance of surveys, Guidelines for alignment and route location. Stages in developing facilities, Road infrastructure development process-steps: Preparation of reports, economic and financial viability, EIA, Preparation of bid document, Tendering process, Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: Laws of Contracts, Award of contract, letter of intent, letter of acceptance and notice to proceed. Features / elements of standard Tender document. Subcontracts, Potential Problems, Post Contract Problems, Documents, Conditions, Arbitration, Special Features of International Contracts, contract forms-FIDIC, CPWD, NHAI. Cost optimization and resource management.

Laboratory Sessions/ Experimental learning:

- Refer standard contract forms and identify important clauses.

Applications:

- Analyzing tender document and contract agreement.

Video link / Additional online information:

- <https://nptel.ac.in/courses/105105107/>

| Module-2   | L3 | 12 Hrs. |
|--|----|---------|
| <p>Estimation and Rate analysis. Measurement of road work.</p> <p>Road construction equipment – different types of excavators, graders, soil compactors / rollers, pavers and other equipment for construction of different pavement layers – their uses and choice, productivity calculation. Problem on equipment usage charges. Investment on equipment, depreciation.</p> <p>Pre-construction surveys and marking on ground - Specifications and steps for the construction of road formation in embankment and cut, construction steps for granular sub-base, quality control tests.</p> <p>Laboratory Sessions/ Experimental learning:</p> <ul style="list-style-type: none"> <li>• Refer standard contract forms and identify important clauses.</li> </ul> <p>Applications:</p> <ul style="list-style-type: none"> <li>• Equipment selection.</li> </ul> <p>Video link / Additional online information:</p> <ul style="list-style-type: none"> <li>• <a href="https://nptel.ac.in/courses/105103093/">https://nptel.ac.in/courses/105103093/</a>,</li> <li>• <a href="https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/105104161/lec12.pdf">https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/105104161/lec12.pdf</a>,</li> <li>• <a href="https://syedsohailuddin.files.wordpress.com/2018/07/is-1200-17.pdf">https://syedsohailuddin.files.wordpress.com/2018/07/is-1200-17.pdf</a>.</li> </ul> |    |         |
| Module-3   | L3 | 12 Hrs. |
| <p>Requirements of pavement, flexible pavement and rigid pavement. Types of flexible pavement, layers, failure criteria.</p> <p>Different types of granular base course – WMM, CRM, WBM; specifications, construction method and quality control tests. Different types of bituminous layers for binder and surface courses; their specifications (as per IRC and MORTH); construction method and quality control tests.</p> <p>Laboratory Sessions/ Experimental learning:</p> <ul style="list-style-type: none"> <li>• Quality tests of aggregate.</li> </ul> <p>Applications:</p> <ul style="list-style-type: none"> <li>• Quality control during construction.</li> </ul> <p>Video link / Additional online information:</p> <ul style="list-style-type: none"> <li>• <a href="https://nptel.ac.in/content/storage2/courses/105101087/downloads/Lec-19.pdf">https://nptel.ac.in/content/storage2/courses/105101087/downloads/Lec-19.pdf</a></li> </ul>   |    |         |
| Module-4   | L3 | 12 Hrs. |
| <p>Rigid pavement- types and failure criteria.</p> <p>Different types of sub-base and base course for cement concrete (CC) pavement and construction method. Construction of cement concrete (PQC) pavements joints quality control during construction.</p>   |    |         |

Construction details of interlocking concrete block pavements.

Applications:

- Quality control during rigid pavement construction.

Video link / Additional online information:

- <https://nptel.ac.in/content/storage2/courses/105101087/downloads/Lec-19.pdf>.

**Module-5**

**L3**

**12 Hrs.**

Principle of construction planning, application of CPM and PERT, Problems, Road maintenance works – day to day and periodic maintenance works of various components of road works and road furniture.

Laboratory Sessions/ Experimental learning:

- Prepare construction program in MS Project and do resource allocation.

Applications:

- Use MS Project software.

Video link / Additional online information:

- <https://nptel.ac.in/courses/105103093/>

**Course outcomes:** On completion of the course, students would be able to

|     |   |
|-----|---|
| CO1 | Identify best alignment, prepare project report and comprehend contract document. |
| CO2 | Select equipment for road construction project.                                   |
| CO3 | Assess quality of materials.  |
| CO4 | Inspect and control quality of work   |
| CO5 | Apply CPM and PERT in construction planning                                       |

**Reference Books:**

|    |   |
|----|---|
| 1. | Peurifoy.R.L., 'Construction Planning, Equipment and Methods', McGraw Hill Publishers, New York,2000. |
| 2. | S.C.Sharma, 'Construction Equipment and its Management', Khanna Publishers, New Delhi, 1988.          |
| 3. | Asphalt Technology and Construction Practices, The Asphalt Institute, Maryland, USA, 1997.            |
| 4. | Relevant IS, IRC, AASHTO and MoRTH Publications.  |

**CO-PO Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1   | 2   | 1   | 2   |     |     | 2   |     | 1   | 2   |      |      |      |
| CO2   | 2   | 1   | 2   |     |     | 3   | 2   |     | 2   |      |      |      |
| CO3   | 2   | 2   | 2   |     | 2   | 3   | 2   |     | 2   |      |      |      |
| CO4   | 1   | 2   | 2   |     |     | 3   | 2   | 1   | 2   | 1    | 1    |      |
| CO5   | 3   |     | 2   |     | 1   |     |     |     |     |      | 1    |      |

High-3, Medium-2, Low-1

|                            |                                   |                       |       |
|----------------------------|-----------------------------------|-----------------------|-------|
| Course Title               | <b>ROAD SAFETY AND MANAGEMENT</b> | Semester              | III   |
| Course Code                | MVJ19CTE321                       | CIE                   | 50    |
| Total No. of Contact Hours | 60 L : T : P :: 40 : 10 : 10      | SEE                   | 50    |
| No. of Contact Hours/week  | 3                                 | Total                 | 100   |
| <b>Credits</b>             | 3                                 | <b>Exam. Duration</b> | 3 Hrs |

**Course objective is to:**

- Explain different parameters responsible for providing road safety in the construction of new roads
- Describe road reconstruction principle and improvement of road considering the different components of road and intersections
- Discuss road safety and maintenance measures for road in operation considering pedestrian, cyclists and road furniture
- Define road safety audit principle and procedure, various traffic management techniques and their effectiveness

**Module-1**

**L3**

**12 Hrs.**

**Road accidents, Causes, Scientific Investigations and Data Collection:** Accident Analysis considering different scenarios, Analysis of Individual accidents to arrive at Real Causes, Statistical Methods of Analysis of Accident Data.

Laboratory Sessions/ Experimental learning:

- Analyzing any accident at a nearby junction

Applications:

- Accident analysis and finding the speed of vehicles involved in the accident.

Video link / Additional online information:

- <https://youtu.be/7I9Eyz9aSZs>
- [https://nptel.ac.in/content/storage2/courses/105101008/downloads/cete\\_42.pdf](https://nptel.ac.in/content/storage2/courses/105101008/downloads/cete_42.pdf)

**Module-2**

**L3**

**12 Hrs.**

**Ensuring Traffic Safety in Designing New Roads:** Ways of Ensuring Traffic Safety in Road Design considering the Features of Vehicle Fleet, Psychological Features of Drivers, Natural and Meteorological Conditions, Structure of Traffic Streams, Orientation of a Driver on the Direction of a Road beyond the Limits of Actual Visibility and Roadway Cross Section and Objects on the Right-

of-Way.

Laboratory Sessions/ Experimental learning:

- Surveying newly constructed road with respect to safety parameters stated in the module.

Applications:

- Understanding how different conditions affect safety on New roads.

**Module-3**

**L3**

**12 Hrs.**

**Ensuring Traffic Safety in Road Reconstruction:** Road Reconstruction and Traffic Safety, Reconstruction Principles, Plotting of Speed Diagram for Working out Reconstruction Projects, Use of Accident Data in Planning Reconstruction of Roads.

Applications:

- Analyzing the accident data for reconstruction of roads.

**Module-4**

**L3**

**12 Hrs.**

**Ensuring Traffic Safety in Road Operation:** Ensuring Traffic Safety during Repair and Maintenance, Prevention of Slipperiness and Influence of Pavement Smoothness, Restriction speeds on Roads, Safety of Pedestrians, Cycle Paths, Informing Drivers on Road Conditions with Aid of Signs, Traffic Control Lines and Guide Posts, Guardrails and Barriers and Road Lighting.

Laboratory Sessions/ Experimental learning:

- Conducting a pedestrian safety survey at Hopeform junction and analyzing the results.

**Module-5**

**L3**

**12 Hrs.**

**Road Safety Audit and Traffic Management Techniques:** Principles- Procedures and Practice, Code of Good Practice and Checklists. Road safety issues and engineering, education, enforcement measures for improving road safety. Local area management. Low cost measures, area traffic control.

Laboratory Sessions/ Experimental learning:

- Analyzing the safety of road with respect to engineering parameters on a stretch of road nearby.

Video link / Additional online information:

- <https://youtu.be/LH8ojQIIYWw>

|  |   |
|--|---|
| <b>Course outcomes:</b> On completion of the course, students would be able to |   |
| CO1  | Recognize the factors affecting the construction of new roads   |
| CO2  | Illustrate the factors affecting the reconstruction of existing roads   |
| CO3  | Summarize the factors affecting the operation condition of road   |
| CO4  | Remember and illustrate the process of road safety audit and the measures of improving road safety. Qualified to evaluate the effectiveness of various management techniques adopted in reducing road accident. |
| CO5  | Recognize the factors affecting the construction of new roads   |

|                         |   |
|-------------------------|---|
| <b>Reference Books:</b> |   |
| 1.                      | Babkov, V.F. 'Road conditions and Traffic Safety', MIR publications, Moscow - 1975.   |
| 2.                      | K.W. Ogden, 'Safer Roads – A Guide to Road Safety Engg.' Averbury Technical, Ashgate Publishing Ltd., Aldershot, England, 1996.                     |
| 3.                      | Kadiyali, L.R., 'Traffic Engineering and Transport Planning', Khanna Publications, New Delhi, 2009.   |
| 4.                      | Jotin Kishty and B. Kent Lall, 'Transportation Engineering-An Introduction', Third Edition, Prentice Hall of India Private Limited, New Delhi, 2006 |
| 5.                      | Relevant IRC Publications.  |
| 6.                      | MORTH "Manual for Road Safety in Road Design"- Indian Roads Congress  |

| <b>CO-PO Mapping</b> |     |     |     |     |     |     |     |     |     |      |      |      |
|----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO/PO                | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1                  | 2   | 1   | 2   | -   | 1   | 1   | -   | 1   | 1   | 1    | 1    | 2    |
| CO2                  | 2   | 2   | 2   | 1   | -   | 2   | 1   | 1   | 1   | 2    | 1    | 1    |
| CO3                  | 3   | 2   | 2   | 2   | 2   | 3   | 2   | -   | 1   | 1    | 1    | 1    |
| CO4                  | 2   | 2   | 2   | 1   | -   | 2   | 1   | 1   | 2   | 1    | 1    | 1    |
| CO5                  | 2   | 2   | 1   | 1   | -   | 2   | 1   | 2   | 1   | 1    | 1    | 1    |

High-3, Medium-2, Low-1

|                            |   |                       |         |
|----------------------------|---|-----------------------|---------|
| Course Title               | <b>INTELLIGENT<br/>TRANSPORTATION SYSTEMS</b> | Semester              | III     |
| Course Code                | MVJ19CTE322                                   | <b>CIE</b>            | 50      |
| Total No. of Contact Hours | 60 L: T : P :: 40 : 0 : 20                    | <b>SEE</b>            | 50      |
| No. of Contact Hours/week  | 3   | <b>Total</b>          | 100     |
| <b>Credits</b>             | 3   | <b>Exam. Duration</b> | 3 Hours |

**Course objective is to:**

- Have an awareness and scope of transport issues, such as, traffic safety, public transport, advanced vehicle management and control.
- Learn how Intelligent transport systems (ITS) involve the application of information technology and telecommunications to control traffic, inform travelers and drivers, operate public transport, automating payments, handle emergencies and incidents, operate Commercial fleets and freight exchange, and automate driving and safety.

**Module-1**

**L3&L4**

**12 Hrs.**

Basic elements of intelligent transportation systems (ITS), focusing on technological, systems and institutional aspects. Benefits of ITS -ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection

**Module-2**

**L3&L4**

**12 Hrs.**

Advanced traveller information systems; transportation network operations; commercial vehicle operations and intermodal freight

**Module-3**

**L3,L4 &L5**

**12 Hrs.**

Public transportation applications, ITS and regional strategic transportation planning, including regional architectures.

Video link / Additional online information:

- [https://nptel.ac.in/content/storage2/courses/105101008/downloads/cete\\_48.pdf](https://nptel.ac.in/content/storage2/courses/105101008/downloads/cete_48.pdf)

**Module-4**

**L3,L4 &L5**

**12 Hrs.**

ITS and changing transportation institutions, ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS and sustainable mobility

**Module-5**

**L3,L4 &L5**

**12 Hrs.**



Travel demand management, electronic toll collection, and ITS and road-pricing. Automated Highway Systems- Vehicles in Platoons –ITS in World – Overview of ITS implementations in developed countries, ITS in developing countries.

Video link / Additional online information:

- [https://nptel.ac.in/content/storage2/courses/105101008/downloads/cete\\_49.pdf](https://nptel.ac.in/content/storage2/courses/105101008/downloads/cete_49.pdf)

**Course outcomes:**

|     |  |
|-----|--|
| CO1 | Describe the different techniques adopted in the Intelligent Transportation systems (ITS)            |
| CO2 | Develop the appropriate system/s in various functional areas of transportation.                      |
| CO3 | Establish the integration of various systems, plan and implement the applications of ITS             |
| CO4 | Erudite the application of information technology and telecommunication systems to control traffic   |
| CO5 | Afford advance information to the travelers, automatic handling of emergencies and to improve safety |

**Reference Books:**

|    |   |
|----|---|
| 1. | Choudury M A and Sadek A, “Fundamentals of Intelligent Transportation Systems Planning” Artech House Publisher, 2003, Pp.210                                    |
| 2. | Kan Paul Chen and John Miles, “Recommendations for World Road Association (PIARC)/PIRAC Committee on Intelligent Transport”, Artech House, 1999, Pp.434         |
| 3. | Sussman, J. M., “Perspective on ITS”, Artech House Publishers, 2005   |
| 4  | US Department of Transportation, “National ITS Architecture Documentation”, 2007 (CD-ROM)   |
| 5  | Turban. E and Aronson. J. E, “Decision Support Systems and Intelligent Systems, 7 <sup>th</sup> Edition”, Prentice Hall of India Private Limited , 2007, Pp.960 |

**CO-PO Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1   | 2   | 1   | 1   | 1   | -   | 2   | -   | -   | 1   | 1    | 1    | 1    |
| CO2   | 2   | 2   | 1   | 1   | -   | 2   | -   | -   | 1   | 2    | 1    | 1    |
| CO3   | 2   | 3   | 1   | 2   | 3   | 2   | 1   | -   | 2   | 3    | 2    | 1    |
| CO4   | 2   | 3   | 3   | 2   | 3   | 3   | 2   | -   | 2   | 2    | 2    | 2    |
| CO5   | 3   | 3   | 3   | 3   | 2   | 3   | 2   | -   | 3   | 3    | 3    | 3    |

High-3, Medium-2, Low-1

|                     |                                  |                       |       |
|---------------------|----------------------------------|-----------------------|-------|
| Course Title        | <b>INFRASTRUCTURE MANAGEMENT</b> | Semester              | III   |
| Course Code         | MVJ19CTE323                      | <b>CIE</b>            | 50    |
| Total Contact Hours | 60 L : T : P :: 40 : 00 : 20     | <b>SEE</b>            | 50    |
| Contact Hours/week  | 3                                | <b>Total</b>          | 100   |
| <b>Credits</b>      | 3                                | <b>Exam. Duration</b> | 3 Hrs |

**Course objective is to:**

- Discuss the need of Infrastructure Management in planning and maintaining the Infrastructures
- Discuss the performance of Infrastructures, causes of failure, rating methods
- Formulate the development and application of models for Infrastructure management
- Discuss the need of application of methods of prioritization and application of innovative methods.

**Module-1**

**L3**

**12 Hrs.**

*Prerequisites: Knowledge on development of infrastructure*

**Introduction:** The Challenge of Managing Infrastructure- Infrastructure and Society-Definition-Infrastructure Assets-Life Cycle analysis-Infrastructure Crisis-Infrastructure Management- An integrated approach.

Experimental learning:

- In-situ evaluation of management in infrastructure

Applications:

- In managing the infrastructure

Video link:

- <https://nptel.ac.in/courses/105/106/105106188/>

**Module-2**

**L3 & L4**

**12 Hrs.**

**Infrastructure Management:** Framework for Infrastructure Management: Background-Key issues-Application of system Methodology-Development of IMS- Life cycle analysis Concept. Planning, Needs, Assessment and Performance Indicators: Planning-Examples on planning- Life Cycle Management-Infrastructure Service life- Needs Assessments- Performance.

Experimental learning:

- Planning the life cycle analysis of infrastructure

Applications:

- In infrastructure management

Video link:

- <https://nptel.ac.in/courses/105/106/105106115/>

### Module-3

L3

13 Hrs.

*Prerequisites: Knowledge on quality control on pavement*

**Evaluation Technologies :** Database Management: Information Management-Database Development and Management- Needs-Analysis And Modelling Techniques-Security-Quality Control and assurance Issues. In-service Monitoring and Evaluation Data:-Needs- In service evaluation of Physical assets- Technologies for Evaluation- Methods- Issues- Examples-Road and Airport Pavements-Rail Road Tracks-Bridges- Buildings.

Experimental learning:

- In-situ quality control checks for the airport pavements

Applications:

- In airport and railways

Video link:

- <https://nptel.ac.in/courses/105/106/105106115/>

### Module-4

L3

12 Hrs.

*Prerequisites: Knowledge on the designing the infrastructure*

**Design and construction:** Performance Modelling and Failure Analysis: Performance evaluation-Modelling-Failure Analysis. Design and Construction for Infrastructure Service life:- Introduction-Design-Objectives and Constraints- Design Framework-Design Effectiveness- Construction-Construction as related to other phases of Management- Constructability-Quality Control and Quality assurance.

Experimental learning:

- In-situ quality control checks for the infrastructure

Applications:

- In identifying infrastructure service life

Video link:

- <https://nptel.ac.in/courses/105/106/105106115/>

| Module-5   | L6 | 11 Hrs. |
|--|----|---------|
| <p><b>Prerequisites:</b> Knowledge on rehabilitation and reconstruction</p> <p><b>Importance of maintenance:</b> Maintenance, Rehabilitation, and Reconstruction (M,R &amp; R) Strategies- Definition- Maintainability- Rehabilitation-Reliability-Maintenance management- Operation–IIMS-Examples on IIMS studies.</p> <p>Experimental learning:</p> <ul style="list-style-type: none"> <li>In-situ identification of maintenance requirements and material properties of infrastructure.</li> </ul> <p>Applications:</p> <ul style="list-style-type: none"> <li>In evaluation of the service of the infrastructure</li> </ul> <p>Video link:</p> <ul style="list-style-type: none"> <li><a href="https://nptel.ac.in/courses/105/106/105106115/">https://nptel.ac.in/courses/105/106/105106115/</a></li> </ul> |    |         |

| <b>Course outcomes:</b> On completion of the course, students would be able to |  |
|--|--|
| CO1  | Identify the factors influencing performance of Infrastructure     |
| CO2  | Carry out structural and functional evaluation of infrastructure   |
| CO3  | Explain the use of models for Infrastructure management            |
| CO4  | Develop a framework for efficient Infrastructure management system |
| CO5  | Identification of maintenance requirements of the infrastructure   |

| <b>Reference Books:</b> |  |
|-------------------------|--|
| 1.                      | Infrastructure Management: Design, Construction, Maintenance, Rehabilitation, Renovation, .W. Ronald Hudson, Ralph Haas and Waheed Uddin, McGraw Hill Co., 1997. |
| 2.                      | Infrastructure Engineering and Management Neil S. Grigg, John Wiley and Sons.  |
| 3.                      | Modern Pavement Management ,W. Ronald Hudson, Ralph Haas and Zeniswki, McGraw Hill and Co.   |

| <b>CO-PO Mapping</b> |     |     |     |     |     |     |     |     |     |      |      |      |
|----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO/PO                | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1                  | 1   | -   | -   | -   | 1   | 3   | 1   | -   | -   | -    | 1    | 1    |
| CO2                  | 2   | 3   | -   | -   | 1   | -   | 1   | -   | -   | -    | 1    | 1    |
| CO3                  | 1   | 2   | 3   | -   | -   | 1   | 1   | -   | -   | -    | 1    | 1    |
| CO4                  | 3   | 1   | 1   | 1   | -   | -   | -   | 1   | -   | -    | 1    | -    |
| CO5                  | 1   | 2   | 1   | -   | -   | 2   | -   | -   | -   | -    | 1    | 3    |

High-3, Medium-2, Low-1

|                            |                              |                       |       |
|----------------------------|------------------------------|-----------------------|-------|
| Course Title               | <b>RURAL ROADS</b>           | Semester              | III   |
| Course Code                | MVJ19CTE331                  | <b>CIE</b>            | 50    |
| Total No. of Contact Hours | 60 L : T : P :: 40 : 00 : 20 | <b>SEE</b>            | 50    |
| No. of Contact Hours/week  | 3                            | <b>Total</b>          | 100   |
| <b>Credits</b>             | 3                            | <b>Exam. Duration</b> | 3 Hrs |

**Course objective is to:**

- Explain the concept and objective of providing low cost roads in developing country like India.
- Explain problems involved in the design of rural roads, preparation of rural road development plans and economic viability.
- Explain different types of surveys required for road alignment and road geometry with appropriate specifications.
- Introducing different materials used for construction and different types of construction procedures and equipment required for construction.
- Explain importance of road drainage, design of drainage and cross drainage structures with maintenance activities.

**Module-1**

**L3**

**12 Hrs.**

**Pre requisites:** Basics of Highway Engineering Planning

**Introduction:** Concept Objective, Scope and coverage of low cost and rural roads. Explain significance of low cost roads for developing countries, with special reference to India

Video link / Additional online information:

- <https://ruralroads.org/low-cost-road-surfaces/>
- [https://www.ilo.org/wcmsp5/groups/public/---ed\\_emp/---emp\\_policy/---invest/documents/publication/wcms\\_asist\\_9592.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_policy/---invest/documents/publication/wcms_asist_9592.pdf)
- <http://www.pmgysy.nic.in/pmg931.asp>
- [https://shodhganga.inflibnet.ac.in/bitstream/10603/74747/10/10\\_chapter-3.pdf](https://shodhganga.inflibnet.ac.in/bitstream/10603/74747/10/10_chapter-3.pdf)
- [https://www.academia.edu/19122730/IRC\\_SP\\_020\\_Rural\\_Roads\\_Manual](https://www.academia.edu/19122730/IRC_SP_020_Rural_Roads_Manual)

**Module-2**

**L3**

**12 Hrs.**

**Pre requisites:** Basics of Highway Engineering Planning

**Rural Road Planning and Investment:** Problems associated with planning of low volume rural

roads in India .Rural road network planning- principles and methods. Socio-economic aspects in planning, preparation of rural road master plans and their evaluation: stage construction, planning and utilization of successive investments.

Video link / Additional online information:

- <https://blogs.worldbank.org/transport/the-problem-with-rural-transport-is-that-it-is-rural-the-solution-is-in-branding>
- <http://onlinepubs.trb.org/Onlinepubs/trr/1991/1291vol1/1291-021.pdf>

**Module-3**

**L3**

**12 Hrs.**

**Pre requisites:** Basics of Highway Geometric Design

**Location Surveys and Geometrics Design:** Location surveys, geometric design standards for rural roads, special considerations for rural roads in hilly area.

Video link / Additional online information:

- <https://nptel.ac.in/courses/105/101/105101087/>
- <http://pmgsy.nic.in/archives/nrrda/op4.asp>
- [https://www.academia.edu/19122730/IRC\\_SP\\_020\\_Rural\\_Roads\\_Manual](https://www.academia.edu/19122730/IRC_SP_020_Rural_Roads_Manual)

**Module-4**

**L3**

**12 Hrs.**

**Pre requisites:** Basics of Pavement materials Properties and Types of soil stabilization

**Materials:** Stabilized soils, Design of soil-lime, soil-cement, soil-bitumen and soil-lime-fly ash mixes, Use of soft aggregates. Construction, Operation and Plants: Surveying and setting, excavation, hauling, Shaping and compaction, Stabilized soils-spreading, mixing and compaction. Appropriate technology, tools, plants and equipment for construction as per IRC practices.

Video link / Additional online information:

- <https://www.youtube.com/watch?v=2hHxF2-fK50>
- <https://nptel.ac.in/content/storage2/courses/105108075/module6/Lecture18.pdf>
- <https://nptel.ac.in/content/storage2/courses/105101005/downloads/Lec35.pdf>
- <https://www.diva-portal.org/smash/get/diva2:997144/FULLTEXT01.pdf>

**Module-5**

**L3**

**12 Hrs.**

**Pre requisites:** Highway drainage

**Road Drainage and Maintenance:** Drainage of road surface, pavement layers and cross drainage works. Various low cost drainage alternatives. Short term routine maintenance, long term

maintenance, organizational and financial aspects of maintenance works.

Video link / Additional online information:

- [https://www.academia.edu/19122730/IRC\\_SP\\_020\\_Rural\\_Roads\\_Manual](https://www.academia.edu/19122730/IRC_SP_020_Rural_Roads_Manual)

**Course outcomes:** On completion of the course, students would be able to

|     |  |
|-----|--|
| CO1 | Able to remember significance of low cost roads.   |
| CO2 | Capable of analyzing the problem associated with planning of low volume roads, preparing master plan of rural road network.  |
| CO3 | Capable of conducting surveys for rural road alignment and remembering specifications of various geometric features of road. |
| CO4 | Capable of selecting and analyzing different materials and equipment's required for rural road Construction.                 |
| CO5 | Able design various drainage structures and cross drainage works giving due importance to maintenance activities.            |

**Reference Books:**

|    |   |
|----|---|
| 1. | IRC SP 20, 'Rural Roads Manual, Indian Roads Congress', New Delhi, 2002.                              |
| 2. | Khanna, S.K., Justo, C.E.G., and Veeraragavan, A., 'Highway Engineering', Nem Chand and Bros, Roorkee |
| 3. | HMSO, "Soil Mechanics for Road Engineers", Her Majesty's Stationary Office, London.                   |
| 4. | Relevant IRC Codes & Publications   |
| 5. | International Road Maintenance Hand Book –Maintenance of Paved Roads France                           |
| 6. | International Road Maintenance Hand Book –Maintenance of Unpaved Roads France                         |

**CO-PO Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1   | 3   | 3   | -   | -   | -   | -   | -   | -   | 1   | 1    | -    | 1    |
| CO2   | 3   | 3   | -   | 1   | -   | -   | -   | -   | 1   | 1    | -    | 1    |
| CO3   | 3   | 3   | -   | 1   | -   | -   | -   | -   | 1   | 1    | -    | 1    |
| CO4   | 3   | 3   | 1   | 2   | 1   | -   | -   | -   | 1   | 1    | -    | 1    |
| CO5   | 3   | 3   | 1   | 2   | 1   | -   | -   | -   | 1   | 1    | -    | 1    |

High-3, Medium-2, Low-1

|                            |  |                       |       |
|----------------------------|--|-----------------------|-------|
| Course Title               | <b>ENVIRONMENTAL IMPACT<br/>ASSESSMENT OF<br/>TRANSPORTATION<br/>PROJECT</b> | Semester              | III   |
| Course Code                | MVJ19CTE332  | <b>CIE</b>            | 50    |
| Total No. of Contact Hours | 60 L : T : P :: 40 : 00 : 20   | <b>SEE</b>            | 50    |
| No. of Contact Hours/week  | 3  | <b>Total</b>          | 100   |
| <b>Credits</b>             | 3  | <b>Exam. Duration</b> | 3 Hrs |

**Course objective is to:**

- Explain the concepts of environmental impact assessment and apply in the projects.
- List and define various indicators such as terrestrial subsystems, Indicators aquatic subsystems Socio-economic and able to Select various indicators for EIA studies.
- Explain the impacts of transportation related components on environment
- Explain and illustrate the methodologies for environmental impact assessment

**Module-1**

**L3**

**12Hrs**

***Prerequisites:** Knowledge on basic impacts on environment pollution.*

**Introduction:** Environment and its interaction with human activities- Environmental imbalances – Attributes, Impacts, Indicators and Measurements-Concept of Environmental Impact Assessment (EIA), Environmental Impact Statement, Objectives of EIA, Advantages and Limitations of EIA.

Laboratory Sessions/ Experimental learning:

- Documentation on EIA guidelines.

Applications:

- Able get a knowledge of rules and regulations of EIA.

Video Link:

- [http://www.kspcb.gov.in/Acts\\_Rules.html](http://www.kspcb.gov.in/Acts_Rules.html)

**Module-2**

**L3**

**12Hrs**

***Prerequisites:** Knowledge on preventing of environment.*

**Environmental Indicators:** Indicators for climate - Indicators for terrestrial subsystems - Indicators for aquatic subsystems – Selection of indicators – Socio-economic indicators – Basic information – Indicators for economy – Social indicators – Indicators for health and nutrition – Cultural indicators – Selection of indicators.



Laboratory Sessions/ Experimental learning:

- Documentation work on Environmental indicators for given project.

Applications:

- Able get a knowledge of Environmental indicators and its applications.

**Module-3**

**L3**

**12Hrs**

*Prerequisites: Knowledge on EIA guidelines for various components.*

**Environmental Impact Assessment For Transportation Projects:** Basic Concepts, Objectives, Transportation Related Environmental Impacts – Vehicular Impacts – Safety & Capacity Impacts– Roadway Impacts – Construction Impacts, Environmental Impact Assessment – Environmental Impact Statement, Environment Audit, Typical case studies.

Laboratory Sessions/ Experimental learning:

- Study and analysis of EIA for given transportation project.

Applications:

- Able to get a knowledge of EIA and EC clearance for transportation projects.

Video Link:

- [http://www.kspcb.gov.in/Acts\\_Rules.html](http://www.kspcb.gov.in/Acts_Rules.html)

**Module-4**

**L3**

**12Hrs**

*Prerequisites: Knowledge on preventing methods for environment.*

**Environmental Issues in Industrial Development:** On-site and Off-site impacts during various stages of industrial development, Long term climatic changes, Green house effect, Industrial effluents and their impact on natural cycle, Environmental impact of Highways, Mining and Energy development.

Laboratory Sessions/ Experimental learning:

- Collection of effects on environment through public hearing.

Applications:

- Able obtain different effects and control over environment.

Video Link:

- [http://www.kspcb.gov.in/Acts\\_Rules.html](http://www.kspcb.gov.in/Acts_Rules.html)

| Module-5  |   | L3 | 12Hrs |
|---|---|----|-------|
| <b>Prerequisites:</b> Knowledge on environment protects acts.   |   |    |       |
| <b>Methodologies for Carrying Environmental Impact Assessment:</b> Overview of Methodologies, Adhoc Checklist, Matrix, Network, Overlays, Benefit Cost Analysis, Choosing a Methodology, Review Criteria. |   |    |       |
| Laboratory Sessions/ Experimental learning:   |   |    |       |
| <ul style="list-style-type: none"> <li>Adoption of EIA method for previously collected problems.</li> </ul>   |   |    |       |
| Applications:   |   |    |       |
| <ul style="list-style-type: none"> <li>The EIA can be adopted and can take a control over environment.</li> </ul>   |   |    |       |
| <b>Course outcomes:</b>   |   |    |       |
| CO1   | To describe the environmental imbalances, indicators and explain the concept of EIA   |    |       |
| CO2   | To identify and describe elements to be affected by the proposed developments and/or likely to cause adverse impacts to the proposed project, including natural and man-made environment. |    |       |
| CO3   | To identify the negative impacts and propose the provision of infrastructure or mitigation measures   |    |       |
| CO4   | To assess the impacts of various development on environment   |    |       |
| CO5   | To summarise the methodologies for carrying out environmental impact assessment   |    |       |

| Reference Books: |   |
|------------------|---|
| 1.               | Jain, R.K., Urban, L.V., Stracy, G.S., (1991), " <i>Environmental Impact Analysis</i> ", Van Nostrand Reinhold Co., New York                        |
| 2.               | Rau, J.G. and Wooten, D.C., (1996), " <i>Environmental Impact Assessment</i> ", McGraw Hill Pub.Co., New York                                       |
| 3.               | Canter, L.W., (1997), " <i>Environmental Impact Assessment</i> ", McGraw Hill Pub. Co., NewYork.  |
| 4.               | Grand Jean, E. Gilgen A., " <i>Environmental Factors in Urban Planning</i> ", Taylor and FrancisLimited, London, 1976.                              |
| 5.               | UNESCO, (1987), " <i>Methodological Guidelines for the Integrated Environmental Evaluation of Water Resources Development</i> ", UNESCO/UNEP, Paris |

**CO-PO Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1   | 3   | 3   | 1   | 1   | -   | 3   | 3   | 2   | 1   | 2    | 1    | 2    |
| CO2   | 3   | 3   | 3   | 3   | 1   | 3   | 3   | 2   | 2   | 1    | 2    | 2    |
| CO3   | 3   | 3   | 3   | 3   | 2   | 3   | 3   | 2   | 1   | 2    | 2    | 2    |
| CO4   | 3   | 2   | 3   | 2   | -   | 3   | 3   | 2   | 1   | 1    | 1    | 2    |
| CO5   | 3   | 2   | 3   | 3   | 2   | 3   | 3   | 2   | 2   | 2    | 2    | 2    |

High-3, Medium-2, Low-1

|                            |   |                       |       |
|----------------------------|---|-----------------------|-------|
| Course Title               | <b>PAVEMENT EVALUATION<br/>AND MANAGEMENT</b> | Semester              | III   |
| Course Code                | MVJ19CTE333                                   | <b>CIE</b>            | 50    |
| Total No. of Contact Hours | 60 L : T : P :: 40 : 0 : 20                   | <b>SEE</b>            | 50    |
| No. of Contact Hours/week  | 3   | <b>Total</b>          | 100   |
| <b>Credits</b>             | 3   | <b>Exam. Duration</b> | 3 Hrs |

**Course objective is to:**

- Recall the importance of evaluation and strengthening of pavements.
- Introduce the various methods of structural and functional evaluation of rigid and flexible pavements
- Discuss the need for pavement management and explain the techniques involved
- Formulate the development and application of models for pavement management.

**Module-1**

**L3**

**12 Hrs.**

*Pre requisites: Concept of flexible and rigid pavements*

**Pavement Evaluation :** Introduction- Structural and functional requirements of flexible and rigid pavement; pavement distress; different types of failures, causes and remedial measures.

Laboratory Sessions/ Experimental learning:

- Field survey to identify the types of pavement failures in flexible and rigid pavements
- Material testing laboratory for soils, aggregates, bituminous binders and bituminous mixes

Applications:

- Knowledge on the structural and functional requirements of flexible and rigid pavement
- Understand the different types of pavement failures and the types of remedies in real life problems

Video link / Additional online information:

- <http://nptel.ac.in>

**Module-2**

**L3**

**12 Hrs.**

**Functional evaluation of pavements :**

Evaluation of Surface Condition: Methods of evaluating pavement surface condition, PCI & PSI measurement of skid resistance and unevenness by various methods, their applications.

Laboratory Sessions/ Experimental learning:

- Field methods of evaluating pavement conditions
- Standardization of Automatic Road Unevenness Recorder/ Bump Indicator test

Applications:

- Pavement performance studies can be understood
- Understand the different methods of pavement evaluation

Video link / Additional online information:

- <http://nptel.ac.in>

**Module-3**

**L3**

**12 Hrs.**

**Structural evaluation of pavements:**

Evaluation by non- destructive tests such as FWD, Benkelman Beam rebound deflection using BBD for flexible overlay design, Plate load test, wave propagation and other methods of load tests, evaluation by destructive test methods, and specimen testing.

Laboratory Sessions/ Experimental learning:

- Non- destructive tests such as FWD, Benkelman Beam rebound deflection using BBD

Applications:

- Understand the working methods of different type of NDT
- Knowledge about the procedure of specimen test

Video link / Additional online information:

- <http://nptel.ac.in>

**Module-4**

**L3**

**12 Hrs.**

**Pre requisites:** *Concept of pavement management system*

**Pavement management:** Historical Background -General nature and applicability of systems methodology, basic components of Pavement Management System, planning pavement investments. Design Strategies - Framework for pavement design – design objectives and constraints.

Laboratory Sessions/ Experimental learning:

- Frictional properties of pavement surface

Applications:

- Practical problems faced during the planning and design can be understood
- Understand the basis of design objectives in pavement management

Video link / Additional online information:

- <http://nptel.ac.in>

**Module-5**

**L3**

**12 Hrs.**

**Basic structural response models:** Characterization of physical design inputs – generating alternative pavement design – economic evaluation of alternative design – analysis of alternative design strategies – selection of optimal design strategy. Techniques for developing prediction models – AASHTO, CRRI and HDM models

Laboratory Sessions/ Experimental learning:

- AASHTO, CRRI and HDM models
- Analysis of pavement Deflection data using software

Applications:

- Understand the techniques for developing prediction models
- Development of pavement deterioration models for Indian conditions

Video link / Additional online information:

- <http://nptel.ac.in>

**Course outcomes:** On completion of the course, students would be able to

|     |   |
|-----|---|
| CO1 | Understand importance of evaluation and strengthening of pavements.                                       |
| CO2 | Understand the methods of pavement surface evaluation   |
| CO3 | Gain knowledge of various methods of structural and functional evaluation of rigid and flexible pavements |
| CO4 | Develop a framework for efficient pavement design   |
| CO5 | Formulate the development and application of models for pavement management                               |

**Reference Books:**

|    |  |
|----|--|
| 1. | Yoder, E.J., and Witzack, 'Principles of Pavement Design', 2 nd Edition, John Wiley and Sons (1991)                    |
| 2. | Ralph Haas, W.Ronald Hudson and John Zaniewski, Modern Pavement Management, Kreigar Publishing Company, New York(1994) |
| 3. | M.Y.Stalin, Chapman and Hall Pavement Management for Airports, Roads and Parking Lots, New York                        |
| 4. | Michael Sargious, Pavements and surfacings for Highways and Airports, Applied Science Publishers Limited, London, 1975 |

|    |  |
|----|--|
| 5. | Ralph Haas and Ronald W. Hudson, 'Pavement Management System', McGraw Hill Book Co.1978. |
|----|--|

| <b>CO-PO Mapping</b> |     |     |     |     |     |     |     |     |     |      |      |      |
|----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO/PO                | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1                  | 3   | 2   | 1   | -   | -   | -   | -   | -   | 1   | 1    | -    | 1    |
| CO2                  | 3   | 3   | -   | 1   | -   | -   | -   | -   | 1   | 1    | -    | 1    |
| CO3                  | 3   | 3   | -   | 1   | -   | -   | -   | -   | 1   | 1    | -    | 1    |
| CO4                  | 3   | 3   | 1   | 2   | 1   | -   | -   | -   | 1   | 1    | -    | 1    |
| CO5                  | 3   | 3   | 1   | 2   | 2   | -   | 1   | -   | 1   | 1    | -    | 1    |

High-3, Medium-2, Low-1