**20CE2204- TRANSPORTATION ENGINEERING**

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| **Course Category**  | Professional Core | **Credits** | 3 |
| **Course Type** | Theory | **Lecture - Tutorial - Practical** | 3-0-0 |
| **Prerequisite**  | None | **Sessional Evaluation**  | 40 |
| **Semester End Exam. Evaluation** | 60 |
| **Total Marks** | 100 |

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| **Course Objectives** | 1. To demonstrate the importance of transportation engineering along with the basics of highway alignment.
2. To analyze various highway geometrical elements.
3. To outline the properties of bitumen and aggregate in pavement construction.
4. To design flexible pavements and rigid pavements.
5. To summarize methods of construction and maintenance of pavements.
6. To evaluate methods of traffic surveys and types of traffic control devices.
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| **Course Outcomes** | CO1 | Outline the scope and functions of transportation engineering along with the concepts of highway alignment. |
| CO2 | Analyze and relate highway geometric elements such as super elevation, sight distances, horizontal alignment and vertical curves. |
| CO3 | Perform tests on bitumen and aggregate for assessing their properties and judge their suitability as highway construction materials.  |
| CO4 | Design flexible pavements and rigid pavements |
| CO5 | Understand the construction and maintenance procedures of bituminous and cement concrete pavements. |
| CO6 | Perform different types of Traffic studies and understand different types of traffic control devices |
| **Course Content** | **UNIT - I****HIGHWAY ENGINEERING:** Importance of transportation, Modes of transportation, Characteristics of road transport, Classification of roads, Highway alignment – Basic requirements – Controlling factors – Master plan and its phasing , problems on saturation system concept.**UNIT - II****GEOMETRIC DESIGN:** Highway cross sectional elements - camber, width of pavement, kerbs, road margins, formation width, right of way , Sight distance – types, PIEV theory, factors affecting sight distance, design of sight distance , Pavement surface characteristics, Horizontal alignment – design speed, super elevation, extra widening, Curves **-** types of curves, elements of curves, length of transition curve, Gradient, Vertical curves – Types of summit curves, length of summit curve - problems - Types of valley curves, length of valley curves –problems.**UNIT - III****HIGHWAY MATERIALS:** Aggregates and bitumen **–** Desirable properties, tests on aggregate- crushing test, impact test, angularity number test, flakiness index test, elongation index test, specific gravity and water absorption test, Tests on bitumen- specific gravity test, ductility test, softening point test, penetration test, flash and fire point test, types of bitumen, desirable properties of bituminous mix – Marshall method of bituminous mix design**UNIT - IV****DESIGN OF FLEXIBLE PAVEMENTS**: Types of pavements **-** components and their functions, Comparison of flexible and rigid pavements, Design of flexible pavements – design factors, group index method and IRC method based on CBR value.**DESIGN OF RIGID PAVEMENTS:** Material for rigid pavement and their requirements,Design of rigid pavements **-**westergaard’s stress equations and problems, critical combination of stresses, types of joints – problems on spacing of joints, joint filler materials, joint sealer materials.**UNIT - V****CONSTRUCTION OF PAVEMENTS**: Construction and maintenance of Bituminous pavements – types of bituminous construction, interface treatment, Bituminous surface dressing **-** seal coat, tack coat, prime coat,built-up spray grout- Premix methods, Bituminous macadam- penetration macadam, bituminous concrete, sheet asphalt, mastic asphalt, Cement concrete pavements **-** dry lean concrete, paving quality concrete **-** Construction procedure, tie bars and dowel bars, methods of construction **–** continuous bay method and alternate bay method.**UNIT - VI****TRAFFIC ENGINEERING:** Road user and vehicular characteristics, Traffic studies **-** volume, speed, origin and destination, parking & accident studies (uses, field procedure and presentation of data only), PCU values, types of traffic signs, road markings, traffic signals, signal indications – signal face and types of traffic signal systems. |
| **Textbooks and Reference Books** | **TEXTBOOKS:**1. S.K. Khanna and C.E.GJusto & Veeraraghavulu, *Highway Engineering*, Nemchand &bros, 10th edition, 2018.
2. Dr. L.R Kadiyali, *Principles and Practice of Highway Engineering* Khanna publishers, 7th edition, 2019.
3. C.Venkatramaiah, *Transportation Engineering Vol. I,* Universities Press (India) Private Ltd, 1st edition, 2016.

**REFERENCE BOOKS:**1. Dr. L.R Kadiyali, *Traffic engineering and Transport planning,* Khanna publishers, 9th edition, 2017.
2. Guidelines for the Design of flexible pavements, IRC:37-2001.
3. Guidelines for the Design of rigid pavements for highways, IRC:58-1988.
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**CO-PO Mapping:** 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

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|   | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 1 | - | 1 | 1 | - | 2 | 1 | - | - | - | - | - |
| **CO2** | 3 | 2 | 2 | 2 | 1 | - | - | - | - | - | 2 | 3 |
| **CO3** | 1 | 2 | - | 1 | - | - | - | - | - | - | 3 | 1 |
| **CO4** | 3 | 2 | 2 | 1 | - | - | 1 | - | - | - | 2 | 2 |
| **CO5** | - | - | - | 1 | 2 | - | - | - | - | - | 2 | - |
| **CO6** | 2 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | - |