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Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech. in Civil with Transportation Engineering
(2021-2023)

COURSE CODE	CATE-GORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCE 2105(1)	DSE	Alignment and Geometric Design of Highways	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
Develop an understanding of the principles of geometric design in the context of transportation planning and traffic design.

Course Outcomes (COs):

1. Understand the factors influencing road vehicle performance characteristics and design.
2. Apply basic science principles in estimating stopping and passing sight distance requirements.
3. Design basic horizontal alignment of the highway.
4. Design basic vertical alignment of the highway.

Syllabus:

UNIT I **08 Hrs.**

Principle of Route Selection and Highway Location: Reconnaissance, preliminary and final location surveys; Different studies for route locations; Soil and materials, drainage etc.; Use of aerial photographs and remote sensing in route location; Preparation and presentation of project documents

UNIT II **08 Hrs.**

Highway Financing, Economics and Administration: Financing of highways, revenues and expenditures; Highway financing in India; Economics of Highway improvements; Highway administration and planning in India; Saturation System.

UNIT III **09 Hrs.**

Classification of Highway: Terrain classification, design speed and other factors for geometric design; Uniform and non-uniform acceleration theory.
Cross Sectional Elements: Road lines, building and control lines, roadways, width, shoulders, median and camber
Sight Distances: Analysis of stopping sight distance, intermediate and passing sight distance.

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MTCE 2105(1)	DSE	Alignment and Geometric Design of Highways	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT IV **09 Hrs.**

Horizontal Alignment: Design Radius; Dynamics and motion of vehicle on a curve; Friction between tyre and road surface; Different curves; Super elevation, widening and transition curves, setting of transition spiral, use of tables.

UNIT V **09 Hrs.**

Vertical Alignment: Gradients, grade compensation, relation between gradient and camber; Design of summit and valley curves; Design criteria for hair pin bend; Design of curves in tight locations; Lateral and vertical clearances, under passes, coordination of horizontal and vertical alignment, set back distances

Text Book:

1. Sharma S.K., Principle Practice and Design of Highway Engineering, S. Chand & Company Ltd., 2014
2. Kadiyali L.R., Highway Engineering, Khanna Publishers, 2010

References Books:

1. IRC Special Publication 19-1977, Manual for Survey Investigation and Preparation of Road Project.
2. IRC Special Publication 20-1979, Manual for Route Location, Design Construction and Maintenance of Rural Highways.
3. IRC-73-1980, Geometric Design Standards for Rural Highways.
4. IRC-52-1970, Design Tables for Horizontal Curves for Highways.
5. IRC-52-1973, Recommendation about the Alignment Survey Geometric Design of Hill Roads.

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MTCE 2105(2)	DSE	Bridge Engineering	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
At the end of the course, the student will be able to explain the components of bridges and analyze and design bridges.

Course Outcomes (COs):

1. Understand the design theories for super structure and substructure of bridges
2. Design Culvert, R.C.C T Beam Bridge.
3. Understand the behavior of continuous bridges, box girder bridges.
4. Possess the knowledge to design prestressed concrete bridges.

Syllabus:

UNIT I **08 Hrs.**

Introduction: Design of through type steel highway bridges for IRC loading; Design of stringers, cross girders and main girders; Design of deck type steel highway bridges for IRC loading ; Design of main girders

UNIT II **08 Hrs.**

Steel Bridges: Design of Pratt type truss girder highway bridges; Design of top chord, bottom chord, web members; Effect of repeated loading; Design of plate girder railway bridges for railway loading; Wind effects; Design of web and flange plates; Vertical and horizontal stiffeners.

UNIT III **09 Hrs.**

Reinforced Concrete Slab Bridges: Design of solid slab bridges for IRC loading; Design of kerb; Design of tee beam bridges; Design of panel and cantilever for IRC loading.

UNIT IV **08 Hrs.**

Reinforced Concrete Girder Bridges: Design of tee beam; Courbon's theory; Pigeaud's curves; Design of balanced cantilever bridges, deck slab, main girder; Design of articulation

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MTCE 2105(2)	DSE	Bridge Engineering	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT V **09 Hrs.**

Prestressed Concrete Bridges: Design of prestressed concrete bridges; Preliminary dimensions; Flexural and torsional parameters; Courbon's theory; Distribution coefficient by exact analysis; Design of girder section; Maximum and minimum prestressing forces; Eccentricity; Live load and dead load shear forces; Cable zone in girder; Check for stresses at various section; Check for diagonal tension; Diaphragms; End block; Short term and long term deflections.

Text Book:

1. S. Ponnuswamy, Bridge engineering, Tata McGraw-Hill, 1986.
2. N. Rajagopalan, Bridge superstructure, Narosa Publishing House, 2006.

Reference Books:

1. Victor, D.J., Essentials of Bridge Engineering, Oxford & IBH Publishers Co., New Delhi,1980.

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MTCE 2105(3)	DSE	GIS and Remote Sensing in Transportation Engineering	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
To collect the knowledge about significance of GIS in transportation engineering in terms of utility and precision of data collection.

Course Outcomes (COs):

1. Understand main concepts that define Geographic Information Systems.
2. Describe the geographic space with concepts and terms commonly used to build operating models in GIS.
3. Use diverse techniques and instruments adequately to measure, locate and find bearings on a map and in a field.
4. Photo-interpret basic environmental and socioeconomic variables using photographs taken in Spain. Know and use GIS and its geo-processes and functions.

Syllabus:

UNIT I **08 Hrs.**

Remote Sensing: Physics of remote sensing; Ideal remote sensing system; Remote sensing satellites and their data products; Sensors and orbital characteristics; Spectral reflectance curves; Resolution and multi concept: FC; Interpretation of remote sensing images.

UNIT II **08 Hrs.**

Digital Image Processing: Satellite image; Characteristics and formats; Image histogram; Introduction to image rectification; Image enhancement; Land use and land cover classification system.

UNIT III **08 Hrs.**

Geographic Information System (GIS): Basic concept of geographic data; GIS and its components; Data acquisition, raster and vector formats; Topography and data models; Spatial modelling; Data output; GIS applications.

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MTCE 2105(3)	DSE	GIS and Remote Sensing in Transportation Engineering	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT IV **09 Hrs.**

Global Positioning System (GPS): Introduction; Satellite navigation system; GPS- space segment; Control segment; User segment; GPS satellite signals; Receivers; Static, kinematic and differential GPS.

UNIT V **09 Hrs.**

Applications in Transportation Engineering: Intelligent transport system; Urban transport planning; Accident studies; Transport system management; Road network planning; Collecting road inventory.

Text Book:

1. A.M. Chandra, S.K. Ghosh, Remote Sensing and Geographical Information System, 1st Edition, Narosa Publishing house, 2007.
2. M. Anji reddy, Remote Sensing and Geographical Information Systems, 3rd Edition, B.S. Publications, 2006.

Reference Books:

1. Bernhardsen, Geographic Information Systems, an Introduction, 3rd Edition, Published by John Wiley Sons, 2006.
2. Lillesand T.M. and Kiefer R.W. Remote Sensing and Image Interpretation, 5th Edition John Wiley and Sons, 2008.
3. Peter A Burrough, Principles of Geographical Information Systems, 1st Edition, Oxford publisher, 1998.

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCE 2205(1)	DSE	Design and Construction of Flexible Pavement	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

1. To study the behaviour of pavements under various loads
2. To design the flexible and rigid pavements using different Empirical, semi-empirical and theoretical approaches

Course Outcomes (COs):

Upon completion of this course, the students should be able to:

1. Know the stresses, strains and deflections in flexible pavements; traffic loading; and material characterization.
2. Design methodologies for flexible pavements
3. Understand the structural and functions failure and the evaluation of pavements

Syllabus:

UNIT I **08 Hrs.**

Equivalent single wheels load concepts and applications, relationship between wheel arrangements and loading effects, tyre contact area, effect of load repetition, effect of transient loads, impact of moving loading, factors to be considered in design of pavements, design wheel load, soil, climatic factors, pavement component materials, environmental factors, special factors such as frost, freezing and thawing

UNIT II **08 Hrs.**

Design of Flexible Pavements: Methods of design, empirical, semi empirical and analytical, Group index, CBR, California resistance value, Triaxial, MCleod, Burmister and F.A.A. method, IRC method as per revised code using computer software; Design of flexible pavement for airfields

UNIT III **09 Hrs.**

Construction of Flexible Pavements: Type of highway construction, earth road and gravel roads, soil stabilized roads, W.B.M. roads, black top roads, seal coat, prime coat and tack coat, premix, bituminous construction procedures: surface dressing, grouted macadam, bitumen bound macadam, bituminous carpet, Benkelman beam method, pavement roughness and pavement strength, fracture

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MTCE 2205(1)	DSE	Design and Construction of Flexible Pavement	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

patterns and disintegration, present serviceability of pavement system and cost analysis, optional selection of flexible pavement component.

UNIT IV **08 Hrs.**

Design of Bituminous Concrete Mix: Principles of mix design, factors, method, Marshall, Habber and Field, Hveem, Triaxial, comparison of different methods.

UNIT V **08 Hrs.**

Strengthening of Pavement: Types of failure, remedial measurement, pavement evaluation methods using Deflectometer, Benkelman beam as per IRC code

Text Book:

1 Sharma S.K., Principle Practice and Design of Highway Engineering, S Chand & Company, 2014
2 Kadiyali L.R., Highway Engineering, Khanna Publication
3 Kadiyali L.R., Principles of Highway Engineering, Khanna Publication

References Books:

1 IRC Special Publication 19-1977, Manual for Survey Investigation and Preparation of Road Project.
2 IRC Special Publication 20-1979, Manual for Route Location, Design Construction and Maintenance of Rural Highways.
3 IRC-73-1980, Geometric Design Standards for Rural Highways.
4 IRC-52-1970, Design Tables for Horizontal Curves for Highways.
5 IRC-52-1973, Recommendation about the Alignment Survey Geometric Design of Hill Roads.

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MTCE 2205(2)	DSE	Airport Planning and Design	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
Upon completion of the course, students should be able to:

1 Understand the aviation system and its functions
1. Know the airport planning process
2. Conduct studies for the various elements of an airport master plan
3. Plan and design basic airport facilities such as runways, taxiways, etc.

Syllabus:

UNIT I **08 Hrs.**

Aircraft Characteristics: Landing gear configurations, aircraft weight, engine types. Atmospheric conditions affecting aircraft performance: air pressure, temperature, wind speed and direction. Aircraft performance characteristics: speed, payload and range, runway performance, declared distances, wingtip vortices.

UNIT II **08 Hrs.**

Air Traffic Management: Air traffic separation rules, vertical separation, flight altitudes, longitudinal separation and lateral separation. Navigational aids, ground based systems, satellite based systems.

UNIT III **08 Hrs.**

Airport Planning and Forecasting: Airport planning studies, airport system plan, airport site selection, airport master plan, airport project plan, forecasting methods, time series method, market share method, econometric modelling, forecasting requirements and applications: airport system plan, airport master plan.

UNIT IV **08 Hrs.**

Geometric Design of the Airfield: Airport classification, utility airports, transports airports, runways, runway configurations, runway orientation, wind rose, estimating runway length, sight distance and longitudinal profile, transverse gradient, airfield separation requirements, obstacle clearance requirements. taxiways and taxi lanes: widths and slopes, taxiway and taxi lane separation requirements, sight distance and longitudinal profile, exit taxiway geometry, location of exit

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MTCE 2205(2)	DSE	Airport Planning and Design	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
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taxiways, design of taxiway curves and intersections, end-around taxiways.

UNIT V **08 Hrs.**

Aprons: holding aprons, terminal aprons and ramps, terminal apron surface gradients, Control tower visibility requirements. Structural Design of Airport Pavements: Soil investigation and evaluation, CBR, plate bearing test, young's modulus, effect of frost on soil strength, sub grade stabilization, FAA pavement design methods: equivalent aircraft method, cumulative damage failure method

Text Book:

1 Airport Engineering by Rangwala, Charotar Publishing House Pvt. Ltd.; 17th edition (1 January 2018)
2 Planning and Design of Airport by Asheesh Kumar, Vayu Education of India, Edition: 2, 2020

References Books:

1. Airport Engineering: Planning, Design, and Development of 21st Century Airports, Norman J. Ashford , Saleh Mumayiz , Paul H. Wright

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MTCE 2205(3)	DSE	Geometric Design of Transportation Facilities	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
Develop an understanding of the principles of geometric design in the context of transportation planning and traffic design.

Course Outcomes (COs):

5. Understand the factors influencing road vehicle performance, characteristics, design and discuss financing and economic method for highway.
6. Apply basic science principles in estimating sight distances requirements and cross section elements.
7. Design basic horizontal alignment & vertical alignment of the highway.

Syllabus:

UNIT I **08 Hrs.**

Principle of Route Selection and Highway Location: Reconnaissance, preliminary and final location surveys; Different studies for route locations; Soil and materials, drainage etc.; Use of aerial photographs and remote sensing in route location; Preparation and presentation of project documents.

UNIT II **08 Hrs.**

Highway Financing, Economics and Administration: Financing of highways, revenues and expenditures; Highway financing in India; Economics of Highway improvements; Highway administration and planning in India; Saturation System

UNIT III **10 Hrs.**

Classification of Highway: Terrain classification, design speed and other factors for geometric design; Uniform and non-uniform acceleration theory.
Cross Sectional Elements: Road lines, building and control lines, roadways, width, shoulders, median and camber.
Sight Distances: Analysis of stopping sight distance, intermediate and passing sight distance.

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MTCE 2205(3)	DSE	Geometric Design of Transportation Facilities	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT IV **10 Hrs.**

Horizontal Alignment: Design Radius; Dynamics and motion of vehicle on a curve; Friction between tyre and road surface; Different curves; Super elevation, widening and transition curves, setting of transition spiral, use of tables.

UNIT V **09 Hrs.**

Vertical Alignment: Gradients, grade compensation, relation between gradient and camber; Design of summit and valley curves; Design criteria for hair pin bend; Design of curves in tight locations; Lateral and vertical clearances, under passes, coordination of horizontal and vertical alignment, set back distances

Text Book:

1. Sharma S.K., Principle Practice and Design of Highway Engineering, S. Chand & Company Ltd., 2014
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