



**MAR BASELIOS**  
COLLEGE OF ENGINEERING AND TECHNOLOGY  
**AUTONOMOUS**

**DEPARTMENT OF CIVIL ENGINEERING**

**CURRICULUM & SYLLABUS**  
for  
**M.TECH DEGREE PROGRAMME**  
in  
**TRANSPORTATION ENGINEERING**

**SEMESTERS I TO IV : 2022 SCHEME (AUTONOMOUS)**

**MAR BASELIOS COLLEGE OF ENGINEERING AND TECHNOLOGY**

(Approved by AICTE, Autonomous Institution Affiliated to APJ Abdul Kalam Technological University)

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**M.Tech in Transportation Engineering***CURRICULUM (For students admitted from 2022-2023)***SCHEDULING OF COURSES****i) Knowledge Segments and Credits**

Every course of M. Tech Programme is placed in one of the eight categories as listed in Table 1. No semester shall have more than six lecture-based courses and two laboratory courses, and/or project courses in the curriculum.

**Table 1: Credit Distribution and Knowledge Domains**

Sl. No.	Category	Category Code	Number of Courses	Total Credits
1	Discipline Core Course	DCC	2	6
2	Program Core Course	PCC	3	9
3	Laboratory Course		2	2
4	Program Elective Course	PEC	4	12
5	Mandatory Credit Course (Research Methodology & IPR)	MCC	1	2
6	Industry/ Interdisciplinary Elective	IEC	1	3
7	Internship	PR	1	3
8	Mini Project		1	2
9	Project		2	27
10	MOOC	MOOC	1	2
11	Audit Course	AC	1	-
<b>Total Mandatory Credits</b>				<b>68</b>

**ii) Semester-wise Credit Distribution**

Semester	I	II	III	IV	Total Credits
<b>Credits for Courses</b>	18	18	16	16	<b>68</b>

Semester I							
Slot	Category Code	Course Code	Course Name	L	T	P	Credit
A	PCC	22CE261A	Analysis and Design of Pavement Systems	3	0	0	3
B	PCC	22CE261B	Traffic Engineering	3	0	0	3
C	PCC	22CE261C	Urban Transportation Planning	3	0	0	3
D	PEC	22CE262X	Program Elective 1	3	0	0	3
E	PEC	22CE262X	Program Elective 2	3	0	0	3
S	MCC	22MC061A	Research Methodology & IPR	2	0	0	2
T	PCC	22CE269A	Pavement Materials and Evaluation Lab	0	0	2	1
<b>Total</b>				<b>17</b>	<b>0</b>	<b>2</b>	<b>18</b>

Semester II							
Slot	Category Code	Course Code	Course Name	L	T	P	Credit
A	DCC	22MA060X	Probability, Statistics and Mathematical Techniques	3	0	0	3
B	DCC	22CE260A	Economic Appraisal of Projects	3	0	0	3
C	PEC	22CE262X	Program Elective 3	3	0	0	3
D	PEC	22CE262X	Program Elective 4	3	0	0	3
E	IEC	22CE26XX	Industry/Interdisciplinary Elective	3	0	0	3
S	PR	22CE267A	Mini Project	0	0	4	2
T	PCC	22CE269B	Transportation Planning and Traffic Lab	0	0	2	1
<b>Total</b>				<b>15</b>	<b>0</b>	<b>6</b>	<b>18</b>

Semester III							
Slot	Category Code	Course Code	Course Name	L	T	P	Credit
A	MOOC	-	MOOC	-	-	-	2
B	AC	22AC071X	Audit Course	3	0	0	-
U	PR	22CE277A	Internship	-	-	-	3
W	PR	22CE278A	Dissertation Phase I (Track 1) OR Research Project Phase I (Track 2)	0	0	17	11
<b>Total</b>				<b>3</b>	<b>0</b>	<b>17</b>	<b>16</b>

Semester IV							
Slot	Category Code	Course Code	Course Name	L	T	P	Credit
W	PR	22CE278B	Dissertation Phase II (Track 1) OR Research Project Phase II (Track 2)	0	0	24	16
<b>Total</b>				<b>0</b>	<b>0</b>	<b>24</b>	<b>16</b>

**LIST OF PROGRAM ELECTIVE COURSES**

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262A	Geometric Design of Highways	3	0	0	3
	22CE262B	Advanced Pavement Materials	3	0	0	3
	22CE262C	Pavement Construction and Maintenance	3	0	0	3
	22CE262D	Pavement Asset Management	3	0	0	3
	22CE262E	Traffic Flow Theory	3	0	0	3
	22CE262F	Traffic Simulation Modelling and Applications	3	0	0	3
	22CE262G	Transportation Network Analysis	3	0	0	3
	22CE262H	Road Safety Management	3	0	0	3
	22CE262I	Multimodal Transit Systems	3	0	0	3
	22CE262J	Geoinformatics in Transportation Engineering	3	0	0	3
	22CE262K	Analytical Techniques in Transportation Planning	3	0	0	3
	22CE262L	Green Transportation Systems	3	0	0	3
	22CE262M	Advanced Optimization Techniques for Transportation Engineering	3	0	0	3

**INTERDISCIPLINARY ELECTIVE COURSE**

Slot	Category Code	Course Code	Course Name	L	T	P	Credit
E	IEC	22CE265A	Highway Safety Engineering	3	0	0	3

**INDUSTRY-BASED ELECTIVE COURSE**

Slot	Category Code	Course Code	Course Name	L	T	P	Credit
E	IEC	22CE266A	Data Analytics for Smart Transportation Systems	3	0	0	3
E	IEC	22CE266B	Highway Infrastructure Project Management	3	0	0	3

## **PROGRAM CORE COURSES (PCC)**

Slot	Category Code	Course Code	Course Name	L	T	P	Credit
A	PCC	22CE261A	Analysis and Design of Pavement Systems	3	0	0	3

**SYLLABUS**

Introduction to pavements, subsystems, factors affecting pavement design; Material characterization, Failure criteria for the design of pavements; Analysis of axle loads for pavement design.

Stresses and strains in flexible pavements; Design of flexible pavements – AASHTO Method, Asphalt Institute Method, IRC Method.

Stresses in rigid pavements; Design of rigid pavements – PCA method, AASHTO-1993 method and IRC method.

Introduction to mechanistic empirical pavement design (MEPD-2004).

Use of software for the analysis and design of pavements.

Slot	Category Code	Course Code	Course Name	L	T	P	Credit
B	PCC	22CE261B	Traffic Engineering	3	0	0	3

**SYLLABUS**

Components and characteristics of Traffic stream – road traffic, vehicle and road user.

Traffic stream parameters – Fundamental diagrams of traffic flow, PCU concepts.

Traffic surveys – Data collection and analysis of various traffic parameters.

Studies on parking, headway, pedestrian, accident and congestion.

Traffic controls and regulations, Design of intersections – signals, roundabouts; traffic management measures. Road Safety audit and safety measures.

Slot	Category Code	Course Code	Course Name	L	T	P	Credit
C	PCC	22CE261C	Urban Transportation Planning	3	0	0	3

**SYLLABUS**

Urban transportation planning – process and concepts.

Methods of travel demand estimation, trip generation models, trip distribution models, modal split models and traffic assignment models.

Study of transportation planning software for development of planning models.

Introduction to land use transport models.

## LABORATORY COURSES (PCC)



Slot	Category Code	Course Code	Course Name	L	T	P	Credit
T	PCC	22CE269A	Pavement Materials and Evaluation Lab	0	0	2	1

**SYLLABUS**

Tests on aggregates, tests on bitumen for viscosity grading and performance grading, tests on emulsion.

Bituminous mix design, Tests on bituminous mixes.

Extraction of binder from bituminous mixes.

Structural and functional evaluation of pavements.

Slot	Category Code	Course Code	Course Name	L	T	P	Credit
T	PCC	22CE269B	Transportation Planning and Traffic Lab	0	0	2	1

**SYLLABUS**

Traffic control devices inventory – travel time and delay study, Spot speed study, turning movement and peak hour factor, sight distance and gap study at intersections, level of service analysis, application of queuing analysis.

Parking study – pedestrian facilities, traffic impact studies.

Transportation system performance monitoring – transportation and air quality management. Intelligent transportation system.

Software applications in transportation and traffic engineering – Trans CAD, Vissim, planning software.

## DISCIPLINE CORE COURSES (DCC)

Slot	Category Code	Course Code	Course Name	L	T	P	Credit
A	DCC	22MA060X	Probability, Statistics and Mathematical Techniques	3	0	0	3

**SYLLABUS**

Probability mass functions and probability density functions; distribution functions – mean and variance, fitting of distributions, applications.

Statistical inference – sampling distributions, testing of hypotheses, Regression analysis, curve fitting.

Analysis of variance – Randomized block designs, latin square designs, applications, Transportation problem.

Time series models – testing of ARIMA models. Multivariate Analysis – covariance matrix and principal components.

Slot	Category Code	Course Code	Course Name	L	T	P	Credit
B	DCC	22CE260A	Economic Appraisal of Projects	3	0	0	3

**SYLLABUS**

Demand and supply, elasticity of demand and supply concepts, costs and benefits.

Identification and measurements of transportation costs and benefits.

Characteristics and basic understanding of methods, Ranking of independent alternative projects.

Econometrics and project appraisal, social cost benefit analysis, economic and financial appraisal.

Financing transport infrastructure, preparation of projects, feasibility reports, economic analysis, indirect cost and benefits of transportation projects.

## PROGRAM ELECTIVE COURSES (PEC)

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262A	Geometric Design of Highways	3	0	0	3

**SYLLABUS**

Functional classification of highway system, design controls, objectives of geometric design.

Cross section elements, design specifications, pavement surface characteristics, horizontal alignment of roads, vertical alignment of roads.

Introduction to MX roads software.

Geometric design of intersections, miscellaneous elements, pedestrians, cycle tracks, bus bays, design of on-street and off-street parking facilities.

Guidelines for layout design, traffic signs and markings.

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262B	Advanced Pavement Materials	3	0	0	3

**SYLLABUS**

Relevance of subgrade soil as a foundation for pavements with detailed investigation on characteristics, soil classification systems and soil stabilization techniques.

Materials used for pavement construction like aggregates, bitumen, emulsion and cutback, cement, concrete, geosynthetics, industrial wastes – characterization.

Bituminous pavement mixes – types, properties and different mix design methods.

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262C	Pavement Construction and Maintenance	3	0	0	3

**SYLLABUS**

Construction procedures for various flexible pavement component layers and study on latest equipment used for pavement construction, drainage.

Cement Concrete pavement Construction and Maintenance – Construction of Cement Roads, Manual and Mechanical Methods, Joints in Concrete and Reinforced Concrete Pavement and Overlay Construction.

Interlocking block pavements, Non-destructive tests and specialty applications on pavement engineering.

Recycling of pavements.

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262D	Pavement Asset Management	3	0	0	3

**SYLLABUS**

Pavement management process – Concepts, levels, application of Pavement Management System.

Pavement condition data requirements – data needs, characterizing pavement performance, evaluation of structural capacity of pavements, surface distress condition, evaluation of safety Determining present and future needs and priority programming of rehabilitation and maintenance – deterioration prediction models, determining needs, priority programming.

Rehabilitation design and economic analysis – alternate strategies of design and rehabilitation, economic evaluation of alternate pavement design strategies and selection of optimal strategies.

Application of Highway Development and Management Tool (HDM-4) in pavement management.

Implementation of Pavement Management System,

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262E	Traffic Flow Theory	3	0	0	3

**SYLLABUS**

Probabilistic Analysis of Traffic Stream Characteristics.

Microscopic traffic flow models – Car following theories.

Macroscopic traffic flow models – Fluid Dynamic Models.

Transients in Traffic Flow – Shock Wave Analysis; Queuing Theory and Applications.

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262F	Traffic Simulation Modelling and Applications	3	0	0	3

**SYLLABUS**

Statistical models in simulation and overview of probability and statistics.

Random number generation-properties, techniques and various tests, random variate generation, various techniques and methods for generation. Queueing Theory and models- Concepts and characteristics of queueing systems.

Simulation in traffic engineering- Application of traffic simulation models, simulation of queueing models, discrete simulation models.

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262G	Transportation Network Analysis	3	0	0	3

**SYLLABUS**

Network flows – Applications, definitions;

Shortest Path Algorithms – Label setting, Dijkstra’s and Dial’s algorithms, optimality conditions; Minimum cost network assignment – optimality conditions; Network equilibrium analysis; principles and optimization formulations, Applications – Applications of min-cost, max-flow, and shortest path algorithms to transportation and infrastructure networks.

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262H	Road Safety Management	3	0	0	3

**SYLLABUS**

Fundamental concepts of traffic safety – principles and practices.

Strategies adopted in various countries, safety at intersections.

Analysis and interpretation of crash data, Crash mitigation measures, Road safety audit.

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262I	Multimodal Transit Systems	3	0	0	3

**SYLLABUS**

Urbanization and transport, key issues in urban transportation, challenges in urban transportation, travel demand modelling overview.

Introduction to public transportation – basic operating elements of public transportation, bus transportation, intermediate public transportation, public transportation, bus rail transit capacity, transit stop.

Non- Motorised Transportation (NMT) planning, basic NMT characteristics, pedestrian level of service (PLOS) based on flow models.

Bicycle facilities and level of service (BLOS), and bicycle compatibility index (BCI).

Sustainable strategies for urban transportation.

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262J	Geoinformatics in Transportation Engineering	3	0	0	3

**SYLLABUS**

Traffic Engineering Studies and Analysis – sampling in traffic studies, Origin–destination, parking. Concept of PCU, Types of manoeuvres and conflict points.

Transportation Planning using GIS, Traffic Analysis Zone (TAZ) and screen lines, Four Stage Planning Process, Network representation of a transportation System.

Introduction to Intelligent Transport System, Public Transportation Management System, Application of GIS in vehicle routing analysis and visualizations of traffic data in GIS, Travel time analysis using GPS-GIS integration.

GIS-T applications – scope of TransCAD and EMME in Transportation Planning.

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262K	Analytical Techniques in Transportation Planning	3	0	0	3

**SYLLABUS**

Multivariate data analysis techniques- data, estimation of centroid, standard deviation, factor analysis, cross classification procedure, applications.

Network Flow Theory- basic concepts and definitions, forward and reverse star representations, network transformations, applications.

Econometric models, latent variable models, structural equation modeling, duration models, discrete outcome models.

Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262L	Green Transportation Systems	3	0	0	3

**SYLLABUS**

Introduction to the concept of sustainability, basic principles, sustainable transportation planning, land use and travel behaviours, networks, automobile dependence and impacts, design for sustainable transportation, vulnerable road users, professional praxis and paradigm shift, innovations, case studies, emerging concepts, congestion and pollution management, sustainability through public transport, EIA of Transportation Projects.



Category Code	Course Code	Course Name	L	T	P	Credit
PEC	22CE262M	Advanced Optimization Techniques for Transportation Engineering	3	0	0	3

**SYLLABUS**

Concept of uncertainty – Markov analysis, stochastic random process, Dynamic programming approach – applications.

Game theory – solving mixed strategy game; Replacement models.

Fundamentals of network flow theory – shortest route problems – solution of maximum flow model – formulation of CPM-PERT Network.

Time series models – Forecasting models, measurement of trends.

Classical optimization – Optimal problem formulation, Multi criteria mathematical programming problems, Applications of optimization in traffic and pavement management