

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 501** Course Title: **Quantitative Techniques for Infrastructure Systems Analysis**

2. Contact Hours: **L: 3 T: 0 P: 2**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 15 PRS 25 MTE 20 ETE 40 PRE 00**

5. Credits **4** 6. Semester: **Autumn** 7. Subject Area: **PCC**

8. Pre-requisite: **NIL**

9. Objective: To provide knowledge of quantitative techniques with application potential for transportation system.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Modelling and Simulation: Model Classification, Mathematical; Physical and Analog models, steps involved in simulation, Monte Carlo simulation, validation and verification of simulation models.	6
2.	Curve Fitting: Method of least squares, curvilinear regression, Multiple regression, checking adequacy of model, correlation, multiple linear regression (Matrix Notation)	6
3.	Queuing Theory: General structure, operating characteristics, deterministic queuing model, probabilistic queuing models, and simulation of queuing system.	6
4.	Multivariate Data Analysis: Vectors and Matrices, Simple estimate of centroid, standard deviation, dispersion, variance and co-variance, correlation matrices, principal component analysis.	6
5.	Forecasting Models: Moving averages, exponential smoothing, trend projections, causal models, time series analysis of vehicle growth & accidents.	6
6.	Design of Experiments: General principles, completely randomized design, randomized block designs, latin square design, analysis of co-variance.	6
7.	Neural Networks: Basic concepts; neural network architecture, back propagation networks.	6
Total		42

List of Practicals:

- a. Application of linear and non-linear regression
- b. Fitting of probability distributions
- c. Random number generation by midsquare method
- d. Stepwise regression analysis for MLR problem
- e. Demonstration of an industry scale simulation software.
- f. ANN based demand forecasting
- g. Forecasting infrastructure demand.

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication /Reprint
1.	Vohra, N.D., “Quantitative Techniques in Management”, Tata McGraw Hill.	2001
2.	Johnson, R. A. and Wichern, D.W., “Applied Multivariate Statistical Analysis”, Prentice Hall.	2003
3.	Johnson, R., “Probability and Statistics for Engineers”, Prentice Hall.	2009
4.	Hair, J. and Anderson, R., “Multivariate Data Analysis”, Prentice Hall.	2010

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 502** Course Title: **Infrastructure Planning and Management**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits **4** 6. Semester: **Autumn** 7. Subject Area: **PCC**

8. Pre-requisite: **NIL**

9. Objective: To provide an overview of Infrastructure planning and management approaches for building an efficient infrastructure system.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Basic Concepts: Introduction to Infrastructure, Overview of the Power Sector, Water Supply and Sanitation Sector, Road, Rail, Air, and Port Transportation Sectors, Telecommunications Sector, Urban Infrastructure, Rural Infrastructure in India, Organizations and Players in the field of Infrastructure, Infrastructure Project Lifecycle.	8
2.	Challenges to Successful Infrastructure Planning and Implementation Mapping and facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks, Socio-Environmental Risks, Cultural Risks in International infrastructure projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure	8
3.	Strategies for Successful Infrastructure Projects Risk Management framework for Infrastructure Projects, Shaping the planning phase of infrastructure projects to mitigate risks, Designing Sustainable Contracts, Sustainable Development of Infrastructure, Information Technology and Systems for successful infrastructure management, Innovative design and Maintenance of Infrastructure facilities.	10
4.	Performance Evaluation and Life Cycle Analysis Condition assessment, Statistical performance modeling, Inventory management, Capacity management, and Maintenance optimization, Performance Modelling and Life Cycle Analysis Techniques	8
5.	Infrastructure Implementation Capacity Building and Improving the Government's role in infrastructure implementation, An integrated framework for successful Infrastructure Planning and Management – Infrastructure Management Systems and Future Directions	8
Total		42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Goodman, Alvin S. and Makarand Hastak. Infrastructure Planning Handbook: Planning, Engineering, and Economics. McGraw-Hill/ASCE, New York, NY.	2006
2.	Revelle, C.S., Whitlatch, E.E. and Wright, J.R. Civil and Environmental Systems Engineering; Prentice Hall.	2004
3.	Hudson, W.R., Haas, R. and Uddin, W. Infrastructure Management; McGraw Hill	1997
4.	Moss Timothy, Marvin "Urban Infrastructure in Transition; Networks, Buildings, Plans Earthsian Publisher, UK	2000
5.	Verma S.P. ed. "Infrastructure in India's Development: Power, Transport and Communication", Institute of Public Administration, New Delhi	2004

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 503** Course Title: **Public Private Partnership in Transport Infrastructure**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits **4** 6. Semester: **Autumn** 7. Subject Area: **PCC**

8. Pre-requisite: **NIL**

9. Objective: To introduce various aspect of public private participation in the development of transport infrastructure.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Perspectives of Transport Infrastructure Projects in India : railways, roads, civil aviation, ports, urban transport	2
2.	Commercialization Principles: Fixed infrastructure – roads, rail tracks, railway stations, terminals, ports, bus stands	2
3.	Mobile Infrastructure- vehicles, coaches, freight trains, vehicles, coaches, freight trans	2
4.	Various Models of PPP : BOT, BOLT, Fee/Toll Based, Revenue Sharing, Viability Gap Funding, Operation & Maintenance Contracts, Shadow Tolls	3
5.	Allocation and Management of Risks in PPP Projects	3
6.	Project Financing	3
7.	Financial Engineering, Commercial Dynamics of Projects	3
8.	Model Concession Agreements – Highways, Ports, Railways, Airport Terminals	3
9.	Manuals of Standards and Specifications	3
10.	Project Agreements, Construction Contracts, O&M Contracts, Shareholder's Agreement, Insurance Cover, Agreement with Lenders	3
11.	Regulatory Aspects	3
12.	Conditions Precedent : Land free of encumbrances site, Environmental Clearance, Social Impact Analysis Social Concerns	3
13.	Labour Welfare, Labour Productivity	3
14.	Safety Aspects of Facility and Users	3
15.	Case Studies	3
Total		42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Nevitt, P. K. and Fabozzi, F. J. "Project Financing", Euromoney Institutional Investor, Nestor House.	2005
2.	Akintye, A., Beck, M. and Hardcastle, C. "Public Private Partnerships – Managing Risks and Opportunities", Blackwell Publishing.	2003
3.	Grimsey, D. and Lewis, M. K. "Public Private Partnerships – The Worldwide revolution in Infrastructure Provision and Project Finance", Elgar Publishing Ltd.	2007
4.	Sapte, D. W., Public Private Partnerships – BOT Techniques & Project Finance, Euromoney Institutional Investor, Nestor House.	2006

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 504** Course Title: **Barrier Free Environment for Transportation Infrastructure**

2. Contact Hours: **L: 3 T: 0 P: 2**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 15 PRS 25 MTE 20 ETE 40 PRE 0**

5. Credits **4** 6. Semester: **Spring** 7. Subject Area: **PCC**

8. Pre-requisite: **NIL**

9. Objective: This course intends to bring out a holistic understanding of concepts of Barrier Free Design and Planning as deemed necessary for a Transportation System.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Design Standards for Barrier Free Public Transport Access paths, ramps, surface texture, signage, symbols, road marking, traffic control, street furniture, toll plaza, public address system, web based information.	8
2.	Universal Design Theory Concept of Accessibility, Inclusive Design versus Non inclusive Approach, Principles of Universal Design and its areas of application.	4
3.	Barrier Free Public Transportation Terminal Design, Information Systems, Vehicle Loading, Safety issues at Platforms, Vehicle Design, Ticketing & Security, Trip Planning, Ticketing, Access, On board communication, Emergency, Advanced Technology.	8
4.	Access Audit Road System, Railway System, Aviation System, Water Transport.	4
5.	Case Studies Delhi Metro Rail Corporation, Bus Rapid Transit System (Delhi), Bus Shelters, Foot over Bridges, under passes, Modernization of Indira Gandhi International Airport, Nizamuddin Railway Station, INA Street, Circulation networks around tourist places, Public Spaces (Dilli Haat, Garden of Five Senses).	6
6.	Disability Models and Public Policies Medical Model, Social Model and Biosocial model approach to disability, Disability Acts of India, Signapore USA (ADA), UK, Australia, UNCRPD, Biwako Millenium Framework.	4
7.	Research Methodology Data Collection Techniques, Survey Design and Implementation, Reliability and Validity, Linear & non linear Regression analysis, Probabilistic distributions, t-test, chi square test, scaling and rating techniques, Usability Rating Scale (URS), Functional Independence Measure (FIM), Functional Performance Measure (FPM) Analysis, Scaled Modelling.	8
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication/ Reprint
1	Bednar, M. J., “Barrier Free Environments”, Dowden, Hutchinson & Ross, Inc., Community Development Series, Volume 33, Pennsylvania.	2007
2	Barnes, C., Mercer, G., and Shakespeare, T., “Exploring Disability – A Sociological Introduction”, Polity Press.	2003
3	Cochrane and Mathew, “Taal Mael – A Centre for Architectural Research and Development Project Report”, DFID.	2001
4	Preiser, W.F.E., “Universal Design Handbook”, Ostroff, E.	2001
5	Steinfeld, E. and Danford, G. (Eds.), “Enabling Environments – Measuring the Impact of environment on disability and rehabilitation”.	1999
6	Drake, R.F., “Understanding disability policies”, Palgrave Macmillan Press.	1999
7	Imrie, R. and Hall, P., “Inclusive Design – Designing and developing accessible environments”, Spon Press.	2001
8	Disability Standards for Accessible Public Transport, Australia.	2002

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE : **Centre for Transportation Systems (CTRANS)**

1. **Subject Code :** CTN-505 **Course Title :** Project Management and Implementation

2. **Contact Hours:** **L:** 3 **T:** 1 **P:** 0

3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0

4. **Relative Weight:** CWS 25 0 MTE 25 ETE 50 PRE 0

5. **Credits:** 4 6. **Semester:** Spring

7. **Pre-requisite:** Nil 8. **Subject Area:** PCC

9. **Objective:** To impart knowledge on various aspects of infrastructure project management and provide exposure to tools and techniques to manage infrastructure projects.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: National Highway Development Project, Dedicated Freight Corridor Corporation of India Limited (DFCCIL), Development of airport infrastructure , need for project management approach, Over view of capital budgeting, Capital allocation strategy of a firm, ways and means of generating project ideas and screening them	4
2.	Analysis: Steps involved in market and demand analysis, various facets of technical feasibility, financial estimates and projections relating to an infrastructure project	6
3.	Network techniques: Network techniques for Infrastructure Project management, project review and administrative aspects	6
4.	Investment appraisal criteria: Principles of compounding and discounting, various investment appraisal criteria, project cash flows, concept and measurement of cost of capital	5
5.	Infrastructure Project Selection : Project rate of return, capital budgeting decisions, methodology of social cost benefit analysis, mathematical programming for capital budget, options pricing theory, qualitative, strategic, and organisations issues relating to capital budgeting.	5
6.	Financing : Various sources of finance, financing of infrastructure projects, concept and practice of venture capital and private equity	4
7.	Implementation: Pre requisite for successful project implementations, project organisation, project planning and control, Human aspects of Infrastructure Project management,	8
8	Case Studies : Delhi Metro/ Yamuna Expressway/ Hyderabad Airport etc.	4
Total		42

11. Suggested Readings:

S. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Prasanna Chandra, "Projects: Planning, analysis, selection, financing, implementation , and review", Tata McGra Hill Education Private Limited, 7 th Edition	2010
2.	Harold Kerzner, "Project Management: A Systems Approach to Planning, Scheduling, and Controlling", Wiley, 11th Edition	2011
3.	Levy Ferdinand K., Wiest Jerome D., "A Management Guide To PERT/CPM, With GERT /PDM/DCPM and Other Networks," PHI Learning Private Limited, 7th Edition	2009
4.	Srinath L S, "PERT and CPM Principles and Applications" East West Publisher	2001

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 611** Course Title: **Management of Transport Systems**
2. Contact Hours: **L: 3 T: 0 P: 2**
3. Examination Duration (Hrs.): **Theory 3 Practical 0**
4. Relative Weight: **CWS 15 PRS 25 MTE 20 ETE 40 PRE 0**
5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**
8. Pre-requisite: **NIL**
9. Objective: To introduce management of different modules of urban transportation system.
10. Details of Course:

S. No.	Contents	Contact Hours
1.	Pedestrial Facility: Sidewalk, Crosswalk, Subway, Footover bridge, Skywalk, Walkability	6
2.	Cycle Tracks: Cycling accidents, Prediction of cycling Traffic Volume, Flow of Cycle Traffic, and Cycle Track Design	4
3.	Traffic Surveys: Surveys Planning & Design, Observational Survey, Participatory Survey	4
4.	Parking Facilities : On street, Off street, Multi-level parking	6
5.	Traffic Management: Regulatory measures, Physical methods, Signal control	6
6.	Forecasting Travel Demand: Demand Forecasting Approaches, Trip generation, Trip Distribution, Mode Choice, Traffic Assignment	6
7.	Public Transport: Urban bus operation, Bus Rapid Transit System, Exclusive Bus Lane, Mass Rapid Transit System, Monorail	6
8.	Use of IT in Transport Management: Area traffic control, Intelligent highway system, variable signs, toll collection booths	4
Total		42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication/ Reprint
1.	Sigurd, G., “Urban Transportation Systems–Choices for Communities, McGraw Hill.	2002
2.	Forester, J., “Bicycle Transportation – A Handbook for Cycling Transportation Engineers”, MIT Press.	1997
3.	Chrest, A.P., Smith, M.S. & Bhuyan, S., “Parking Structure – Planning Design, Construction, Maintenance & Repair”, Kluwer Academic Publishers Group.	2002
4.	Vuchic, V.R., “Urban Transit – Systems & Technology”, John Wiley & Sons.	2007
5.	Vuchic, V.R., “Urban Transit – Operations, Planning & Economics”, John Wiley & Sons.	2005

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN- 612** Course Title: **Sustainable Transportation Systems**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **NIL**

9. Objective: To impart knowledge and skills of environmental impact assessment (EIA) of transportation systems.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction and Scope; Transportation Systems, EIA	2
2.	Land-use plans, zoning schemes and provisions, Urban and regional transport planning, Legislation on environmental-impact assessment in accordance with the EIA Directive.	4
3.	Impacts on human beings, fauna and flora; soil, water, air, climate, and the landscape; material assets and the cultural heritage; the interaction between the above.	6
4.	Establishment of baseline conditions with respect to soil, water and air quality testing; Noise, air and water pollution modeling	5
5.	Modeling of impacts & scenario-based analysis	5
6.	Assessment of all potential project impacts (including indirect, cumulative and synergistic impacts)	6
7.	Decision support systems for EIA of transport infrastructures	5
8.	Abatement measures, sustainable transport systems	4
9.	Case Studies : Highway Project, Railway project, Airport Project	5
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Assessment & Decision Making for Sustainable Transport, European Conference of Ministers of Transport ,OECD Publishing	2004
2.	Wood, C. and Wood, C., “Environmental Impact Assessment: A Comparative Review”, Prentice Hall.	2002
3.	Petts, J., “Handbook of Environmental Impact Assessment”, Blackwell Publishing.	1999
4.	Sucharov, L.J. and Baldasano, J.M., “Urban Transport and the Environment, Vol. II”, Computational Mechanics Publications.	1996
5.	Zannetti P. (Ed.), “Environmental Modeling, Vol. I”, Computational Mechanics Publication, Elsevier Applied Science.	1993

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 613** Course Title: **Infrastructure Asset Management**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **NIL**

9. Objective: To impart knowledge and skills of infrastructure asset management.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Key issues for Infrastructure Asset Management, Application of Systems Methodology, Development of Infrastructure Management System(IMS)	6
2.	Inventory, Historical and Environmental Data Infrastructure Management Data Needs and Aspects of Inventory Data, Technologies for Inventory and Historic Data Collection, Inventory Data collection and Processing, Institutional issues, Examples on Inventory Data System for Bridges and other infrastructure projects.	6
3.	In-Service Monitoring and Evaluation Data In-service evaluation data needs, In-service evaluation of physical assets, Technologies for In-service monitoring and evaluation, Nondestructive and noncontact structural evaluation, Combined evaluation data.	10
4.	Case Studies of In-Service Evaluation In-service evaluation of road and airport pavements, In-service evaluation of railroad tracks, Evaluation of bridges and buildings.	6
5.	Performance Modelling and Failure Analysis Performance evaluation, Performance modelling, Failure analysis.	6
6.	Maintenance, Rehabilitation and Reconstruction(M, R&R) Strategies: Definitions, Maintainability, Trade-offs among design objectives in relation to maintenance, rehabilitation, Reliability centered maintenance, Maintenance Management, Operations as a part of Infrastructure Management.	8
Total		42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	W.R. Hudson, R. Haas and W. Uddin, Infrastructure Management, McGraw-Hill	1997
2.	Goodman, Alvin S. and Makarand Hastak. Infrastructure Planning Handbook: Planning, Engineering, and Economics. McGraw-Hill/ASCE, New York, NY.	2006
3.	Amekudzi, A. and McNeil. S. Infrastructure Reporting and Asset Management. American Society of Civil Engineers, Virginia.	2008
4.	Performance Measures and Targets for Transportation Asset Management , Issue 551, National Highway Research Program.	2006
5.	AASHTO Transportation Asset Management Guide: A Focus on Implementation.	2011

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 614** Course Title: **Transportation Safety**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **NIL**

9. Objective: To help students accomplish knowledge and skills of analysis of transportation Safety issues.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Road Transport: Introduction – factors for improving safety on roads – causes of accidents due to drivers and pedestrians-design, selection, operation and maintenance of motor trucks-preventive maintenance-check lists-motor vehicles act – motor vehicle insurance and surveys.	8
2.	Driver and Safety: Driver safety programme – selection of drivers – driver training-tacho-graph-driving test driver's responsibility-accident reporting and investigation procedures-fleet accident frequency-safe driving incentives-slogans in driver cabin-motor vehicle transport workers act-road transport act and rules – driver relaxation and rest pauses – speed and fuel conservation – emergency planning	8
3.	Road Safety: Road alignment and gradient-reconnaissance-ruling gradient-maximum rise per k.m. factors influencing alignment like tractive resistance, tractive force, direct alignment, vertical curves-breaking characteristics of vehicle-skidding-restriction of speeds significance of speeds-Ground speed-Pavement conditions – Sight distance – Safety at intersections – Traffic control lines and guide posts-guard rails and barriers – street lighting and illumination-overloading-concentration of driver.	10
4.	Vehicle Safety: Introduction to vehicle safety, Basic concepts of vehicle safety, Risk evaluation, Human error control, Risk communication, Universal design, Crash testing, Crashworthiness, Design of Vehicle Structures for Crash Energy Management, Accident Reconstruction, Future vehicle safety.	8
5.	Transportation of Hazardous Goods: Transport emergency card (TREM) – driver training-parking of tankers on the highways speed of the vehicle – warning symbols – design of the tanker lorries – earth chains-static electricity-responsibilities of driver – inspection and maintenance of vehicles-check list – decanting procedures – communication.	4
6.	Shop Floor and Repair Shop Safety: Transport precautions-safety on manual mechanical handling equipment operations-safe driving-movement of cranes-conveyors etc., servicing and maintenance equipment- battery charging-gasoline handling-other safe practices-off the road motorized equipment	4
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Popkes, C.A., "Traffic Control and Road Accident Prevention", Chapman and Hall Limited	1986
2.	Babkov, V.F., "Road Conditions and Traffic Safety", MIR Publications.	1986
3.	Evans, L., "Traffic Safety & the Driver", Science Serving Society.	1991
4.	Evans, L., "Traffic Safety", Science Serving Society.	2004
5.	Paul, D. B., Chou, C.C., Fileta, B.B., Khalil, T.B., King, A.I., Mahmood, H.F., Mertz, H.J., Wismans, J., "Vehicle Crash Worthiness and Occupant Protection", American Iron and Steel Institute, Michigan	2004
6.	Huang, M., "Vehicle Crash Mechanics" CRC Press, Boca Raton London New York Washington, D.C.	2002
7.	Peters, G.A. and Peters, B.J., "Automotive Vehicle Safety" Taylor & Francis e-Library,	2003

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 615** Course Title: **Inland Navigation and Water Transport**
2. Contact Hours: **L: 3 T: 1 P: 0**
3. Examination Duration (Hrs.): **Theory 3 Practical 0**
4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**
5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**
8. Pre-requisite: **NIL**
9. Objective: To introduce details of various components of inland navigation and water transport.
10. Details of Course:

S. No.	Contents	Contact Hours
1.	Inland Navigation Waterways: Definitions & classifications of waterways, Navigation requirements, Waterway alignment and cutoffs, Multipurpose utilization of waterways	4
2.	River Training Techniques: Erosion control structures, Drifting channel closure methods, Bandalling, surface panels, Bottom panels, submerged vanes, Case studies of river training	5
3.	Canalization and Navigation Canals: Canalization, Navigation Canals	5
4.	River Modelling: Numerical modelling techniques for fairway, Physical modelling of waterways	4
5.	Locks: Locks with direct filling, Locks with indirect filling and emptying, Hydraulics of locks, Lifts and inclined planes, Lock approaches	6
6.	Dredging: Dipper dredges, Hydraulic suction dredges, Cutter head dredges	4
7.	Transport on Inland Waterways: Utilization of inland waterways, Traction, push tow barges, Resistance of ships	4
8.	Economics of Water Transport Systems: Inter-model system, Private Public Partnership	5
9.	Inland Ports and Terminals: Site selection, Physical infrastructure & design	5
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Julien, P. Y., “River Mechanics”, Cambridge University Press, UK.	2002
2.	Novak, P., “Hydraulic Structures”, Spon Press, UK	2004
3.	“Layout and Design of Shallow Draft Waterways”, US Army Corps of Engineers.	1980

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN- 616** Course Title: **Geographic Information System (GIS) Applications in Transportation System**

2. Contact Hours: **L: 3 T: 0 P: 2**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 15 PRS 25 MTE 20 ETE 40 PRE 0**

5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **NIL**

9. Objective: This course provides fundamental concepts of GIS and its applications relevant to various transportation systems.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Definition and components of GIS, Types of data, Mapping process, Coordinate systems, Transformations, Map projections, Geo-referencing, Standard GIS packages.	4
2.	Data Acquisition: Scanners, Digitizers, Digital representation of data, Data structure- Raster and vector data, Data storage.	3
3.	Data Processing: Format conversion, Data Compression and reduction techniques- run length coding, block coding, quadtree, Spatial and non- spatial data, Topology creation.	4
4.	Data Management: Database Structure-Hierarchical, Network, Relational, Database Management Systems.	3
5.	Data Manipulation & Analysis: Reclassification and Aggregation, Analysis of spatial and non spatial data, Modelling in GIS.	4
6.	Implementing in Transportation: Database in terms of link, nodes, point of interest; GIS database design for transport planning, Traffic Analysis Zone (TAZ), Integration of field data with GIS data.	6
7.	GIS Applications (A) Transportation Systems: Accidents and safety analysis, Traffic & Transport analysis, Traffic monitoring systems, Transport infrastructures, environmental impact assessment, congestion management, In-vehicle navigation. (B) Transport Planning: Travel Demand Analysis, Network alignment, Dynamic vehicle routing and scheduling, interchange analysis, Multimodal network planning, Decision Support System for transport planning.	12
8.	Case Studies	6
Total		42

List of Practicals:

1. Study of various types of maps, Maps reading, Measurement from Maps, Datum and Coordinate System.
2. Study of various satellite images, Hard copy Digital Images, Colour and B&W Images and their characteristics.
3. Scanning and digitization of maps. Creation of Point, Line and Polygon data.
4. Creation and Editing of spatial and non-spatial data.

5. Basic functionalities of GIS - Buffer analysis, Union, Intersection, Assigning Weights, Computation of Length, Area and Perimeter.
6. Creation of Digital Elevation Model in 3D, slope map.
7. Spatial Modelling for Traffic and Accident studies.
8. Spatial Modelling for Transport Planning in GIS.

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Baurrough, P.A. "Principles of Geographic Information Systems for Land Resources Assessment", Oxford University Press.	1986
2.	Aromoff, S. "Geographic Information Systems: A Management Perspective", WDL Publications.	1991
3.	Scholten & Stillwen, "GIS for Urban & Regional Planning", Kulwer Academic Publisher.	1990
4.	Clarke, K. "Getting Started with GIS", Prentice Hall.	2001
5.	DeMers, M.N. "Fundamentals of GIS", Johan Wiley & Sons.	2000
6.	Lo, C.P. & Yenung, A. K.W. "Concept and Techniques of GIS", Prentice Hall of India.	2002

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 617** Course Title: **Utility Mapping for Transport Infrastructure**

2. Contact Hours: **L: 3 T: 0 P: 2**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 15 PRS 25 MTE 20 ETE 40 PRE 0**

5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **NIL**

9. Objective: To introduce utility mapping applications, for different types of transport infrastructure.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Utility and Facility Mapping: Introduction, Importance and need scale of mapping.	4
2.	GIS data acquisition and geocoding, Database creation for utility mapping	5
3.	Location based services.	4
4.	Mobile GIS: Introduction, GPS data acquisition, Processing with GIS software, error and uncertainty.	4
5.	Underground Utility Mapping and Survey Techniques: Radar survey, Radar Frequency Location (RFL) survey, Ground Penetrating Radar (GPR) survey.	4
6.	GIS in Transportation: GIS based road network planning, GIS based traffic congestion analysis and accident investigation, decision support systems for land use planning.	4
7.	GIS applications in environment impact assessment: GIS in health, telecommunication, GIS in water supply and energy.	4
8.	Basic theories of data visualization such as data types, chart types, visual variables, visualization techniques, structure of data visualization, navigation in data visualization, evaluation, development of scenarios for transport management for decision making.	4
9.	Case studies	8
Total		42

List of Practicals:

1. Study of various maps and satellite images, Hard copy Digital Images, Colour and B&W Images and their characteristics.
2. Scanning and digitization of maps. Creation of Point, Line and Polygon data.
3. Use of GPR for underground utility mapping.
4. Creation of Utility Mapping Database for Transport Infrastructure.
5. Basic functionalities of GIS - Buffer analysis, Union, Intersection, Network analysis, Assigning Weights, Computation of Length, Area and Perimeter.
6. Creation of Digital Elevation Model in 3D, slope map.
7. Visualization of terrain for Transport Infrastructure

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Miller, H. J. and Shaw, S. L. "Geographic Information Systems for Transportation – Principles & Applications", Oxford University Press.	2001
2.	Easa, S. and Chan, Y. "Urban Planning & Development Applications of GIS", ASCE.	2000
3.	Fry, B. "Visualizing Data", O'Reilly Media Press, USA.	2007
4.	Shamsi, U. M. "GIS Applications for Water, Wastewater and Storm Water Systems", Taylor & Francis.	2005

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 618** Course Title: **Intelligent Transportation System**
2. Contact Hours: **L: 3 T: 1 P: 0**
3. Examination Duration (Hrs.): **Theory 3 Practical 0**
4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**
5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**
8. Pre-requisite: **NIL**
9. Objective: To introduce various dimensions of intelligent transportation system.
10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction to ITS: History of ITS, ITS Legislation and Financing, User Services, Roles and Responsibilities	4
2.	ITS Components : Advanced Traveler Information Systems (ATIS), Advanced Transportation Management Systems (ATMS), including network operations, incident detection; congestion pricing, tolling, Fleet-oriented ITS services, Advanced Public Transportation Systems (APTS); BRT; Commercial Vehicle Operations (CVO); Intermodal Freight, including International Operations and Supply Chains; Automated Highway Systems (AHS), Sensors, Electronic Toll Collection (ETC), Dedicated Short Range Communication; Standards.	12
3.	Communication and Related Techniques: Radio Propagation and Antennas for Wireless Communications; Technologies and Applications of Communication Principles for Transportation.	6
4.	Information & Related Technologies : Intelligent Control Theory, Transportation Information; Vehicle Monitoring & Dispatching System; Advanced Web Pages Programming, Transportation Safety	6
5.	Traffic Control & Chip Design : Traffic Control; Traffic Control System Design on Chip	4
6.	Regionally –scaled ITS deployment, including regional architecture; organization land institutional issues; standards; developed vs. developing countries; ITS and strategic regional transportation planning; integrating infrastructure and operations planning.	4
7.	Critical ITS issues, including (as time permits) ITS and security; safety; human factors; privacy; sustainability; funding (as contrasted with conventional infrastructure); technology deployment/R&D/policy; other institutional issues	4
8.	Conclusion, including regional ITS planning and architecture presentation; the future of ITS	2
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Chowdhury, M. A. and Sadek, A. W., “Fundamentals of Intelligent Transportation Systems Planning”, Artech House.	2003
2.	McQueen, B. and McQueen, J., “Intelligent Transportation System Architectures”, Artech House.	2003
3.	Ghosh, S. and Lee, T., “Intelligent Transportation System - New Principles & Architectures”, CRC Press.	2000
4.	Williams, B., “Intelligent Transportation Systems Standards”, Artech House.	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 619** Course Title: **Bio-fuel for Automobiles**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **NIL**

9. Objective: To impart knowledge related to various aspects of bio-fuels for automobiles.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Biofuel-Alternative to non-renewable fuel: Introduction, Types of Biofuels (First, second, third, and fourth generations), 'Waste to Energy' concept.	4
2.	Ethanol dry milling production: Types of grain and Kernel used, grinding and mashing, Cooking and liquefaction, Fermentation process, Distillation and dehydration, blending with natural gasoline, economic and technical analysis of milling process. Ethanol wet milling process: Steeping of grains with water/acids/alkali, grinding screening and separation, evaporation, drying, fermentation, stillage, distillation and dehydration.	7
3.	Biofuels from Lignocellulosic materials: Pre-treatment of lignocellulosic materials (physico-chemical, and biological), Technology for conversion of sugars to ethanol, other alternative fuels - Biobutenol, 2,3-Butanediol, Life Cycle Assessment and Environmental Impact Analysis of Lignocellulosic ethanol, Current status of lignocellulosic ethanol industries in developing countries, Future prospects.	8
4.	Biodiesel: Definitions, Sources (edible and non-edibles), processes - Transesterifications, thermo-depolymerization, and Biotechnological approaches, Advantages and Disadvantages, Different blends of biodiesel with diesel, Life Cycle Assessment and Environmental Impact Analysis of biodiesel production.	8
5.	Algae-based Biofuels (ABB): Algae based bioenergy as alternative fuels-Biodiesel, Hydrocarbon, Ethanol, Biogas, Cultivation System: Open and close system, Technological Feasibility, Socio-economical aspects of ABB in developing countries.	7
6.	Biofuel Norms and Specifications: Bharat & Euro norms, National/International Legislations and Policies. Retail-economy: <ul style="list-style-type: none"> - The economics of biofuels, subsidies and policy of plantation for biofuel, pricing, taxation, Bioethanol and Biofuel policies, Import/Export of Biofuels. - Cost of ethanol production: from grains, corns, sugarcane, and cellulosic crops in India. - Biofuel distribution and retailing costs, Ethanol transportation cost; Storage/Distribution costs. - Crop market Impacts of biofuel productions. - Case studies on biofuel production. Risk management	8

	<ul style="list-style-type: none"> - An overview of the energy markets, Trading markets, Emission markets, financial options, value at risk. - Emerging Risks in the Biodiesel Production - Relevant Biodiesel Incidental Cases in the Last 5 Years, Storage tank accidents 	
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Olsson, L. and Ahring, B. K., "Biofuels, Advances in Biochemical Engineering/ Biotechnology", Springer-Berlin Heidelberg	2007
2.	Demirbas, A., "Biodiesel: A Realistic Fuel Alternative For Diesel Engines", Springer-Berlin	2008
3.	Wyman, D.C. (Editor), "Handbook on Bioethanol: production and utilization", Taylor & Francis, Washington, DC.	1996
4.	Soetaert, W. and Vandamme, E.J. (Editor), Biofuel, John Wiley & Sons Ltd.	2009
5.	Biofuel for transport: An International Prospective. International Energy Agency (IEA) Publications, France. www.iea.org/books .	2004
6.	Gary, J.H. and Handwerk, G.E., "Petroleum refining technology & Economics", 4 Editions, Marcel Dekker Inc. NewYork.	2001
7.	Meyers, R.A., "Handbook of petroleum refining process", 3 Editions, Mc. Graw Hill hand books.	2003

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 620** Course Title: **Dynamics of Rail & Road Vehicles**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **NIL**

9. Objective: To introduce basic concepts of rail-wheel interaction and engineering principles underlying the control, stability handling, ride behaviour of rail vehicles and cornering behaviour of road vehicles.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction to Vehicle Dynamics : Various kinds of vehicles; motions; mathematical modeling methods; multibody system approach and Lagrangian formulations; methods of investigations; stability concepts.	3
2.	Rail Vehicles: classification & design principles; car-bodies; springs; dampers; car-body tilt; track components, geometry and flexibility, track alignment; track irregularities; track flexibility; track – wheel interaction; track plane acceleration; cant deficiency; vehicle roll & sway; body plane acceleration; creep; normal contact force and contact patch; tangential contact – creep forces; track forces; flange climbing – derailment; vehicle turn over.	7
3.	Dynamic Analysis of Rail Vehicles Wheel-rail geometry; wheel-rail guidance mechanism; simple models for analysis; eigen values & eigen modes; advanced vehicle modeling; wheel sets, bogie frames and car bodies as rigid body models; wheel sets, bogie frames and car bodies as flexible body models; suspension models; lateral dynamic stability; curving and flange steering.	7
4.	Mechanics of Pneumatic Tyre Tyre construction; physics of tyre traction on dry and wet surfaces; cornering properties of tyres; SAE recommended practice; rolling resistance of tyres; ride properties of tyres.	7
5.	Longitudinal Dynamics of Road / Rail vehicles Equation of motion and maximum tractive effort; aerodynamic forces and moments; prediction of vehicle performance; train models; wagon connection models; locomotive traction and dynamic braking; longitudinal train dynamics simulation and crashworthiness; longitudinal comfort; driving practices.	6
6.	Handling and Stability Characteristics of Road Vehicles Steering geometry; steady state handling characteristics; steady state response to steering input; transient response characteristics; directional stability; effects of tyre factors, suspension, braking and vehicle parameters on stability and handling.	6
7.	Ride Characteristics Human response to vibration; standards for comfort levels; appropriate levels of lateral acceleration; motion sickness; vehicle ride models; road / rail surface	6

	profile as a random function; frequency response function; evaluation of vehicle vertical vibration in relation to ride comfort criterion.	
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication/ Reprint
1.	Andersson, E., Berg, M. and Stichel, S., "Rail Vehicle Dynamics", Railway Group KTH, Stockholm.	2007
2.	Wickens A.H., Swets and Zeitlinger, "Fundamentals of Rail Vehicle Dynamics".	2003
3.	Garg V.K. and Dukkipati, R.A., "Dynamics of Rail Vehicle Systems", Academic Press.	1984
4.	Schiehlen W.O. (Ed), "Dynamics of High Speed Vehicles", Springer-Verlag.	1984
5.	Wong J.Y., "Theory of Ground Vehicles", John Wiley.	2008
6.	Thomes, G.D., "Fundamental of Vehicles Dynamics", S.A.E.	1992

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 621** Course Title: **Pipeline Transport System**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **NIL**

9. Objective: To introduce various technological elements of Pipeline Transport.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Route surveying & Planning	5
2.	Types by Transported Substance – For Oil/gas, biofuels, coal.ore, water, hydrogen, other uses. Types by Transport Function – Gathering Pipelines, Transportation pipelines, Distribution Pipelines.	6
3.	Operation, Regulations & Maintenance of Pipeline system.	6
4.	Technology – (a) Components of pipeline system – Initial injection station, Compressor, Partial delivery station, Block valve station, Regulator station, Final delivery station. (b) Leak detection systems.	7
5.	Pipeline network analysis.	4
6.	Hazards, Safety & Environmental management.	5
7.	Pipeline economics.	5
8.	Estimation and costing of Pipeline transport systems.	5
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication/ Reprint
1.	Miller, F.P. and Vandone, A. F., “Pipeline Transport”, Alphascript Publishing.	2009
2.	Evtikhievich, A., “Pipeline Transport – Principles of Design”; Terraspace Publishing.	1982
3.	Mohitpour, M. and Gardeveld, T.V., “Pipeline Operation & Maintenance – A practical approach”; American Society of Mechanical Engineering.	2010
4.	Mohipour, M. and Golshan, H., “Pipeline Design & Construction”, ASME Press	2003

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 622** Course Title: **Railway Infrastructure**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **NIL**

9. Objective: To impart knowledge of various aspects of railway infrastructure.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Railway Geometric Design: Alignment and Surveys, Geometry of Track, Horizontal & Vertical curves, Track elements, Turnouts & Crossings.	4
2.	Rail Operations Management: Crowd control- Passenger Flow management, Time tabling & Inter-running, Managing a Heavy Capacity Light Rail system, Productivity Management, Outsourcing & contractor Management.	4
3.	Track Maintenance Management: Items of track maintenance, Packing & Overhauling of racks, Maintenance Planning, Mechanical Tack Maintenance, directed maintenance of track, Modern Track Management System.	4
4.	Planning, Financial Management & Investment : Railways Social & Economic environment, competition & Impact on Railway Management, Feasibility Studies & method of Financing, Planning the railway activity, Project Management for Railways, Human Resources & their revalorization, Privatization of Railways.	6
5.	High Speed & Magnetic Levitation: High Speed trains: Application of high-speed, Impact of high-speed on reduction of rail travel time, Track Characteristics, Rolling stock for high speeds, Power supply at high-speeds, Tilting trains, Aero trains, Magnetic Levitation.	6
6.	Costing and Pricing of Rail Transport Services: Construction & Maintenance Cost, Fixed & Variable cost, Marginal Cost, Generalized cost, Cost of Operation of Railway company, Tarification of infrastructure: Principles, Objectives, Financial consequences, commercial applications, of infrastructure Pricing, Infrastructure pricing models in some countries.	4
7.	Railway Accidents and Disaster Management	4
8.	Suburban Railways	3
9.	Dedicated Freight Corridor – Construction parameters & Track Structure	3
10.	Forecast of Rail demand: Purposes, Needs, Methods for forecasting, Parameter affecting, Various categories of rail demand, Qualitative methods, Statistical Projections, Econometric models, Gravity models, Fuzzy models, Time-Series models.	4
Total		42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Mundrey, J.S., "Railway Track Engineering", Tata McGraw Hill.	2007
2.	Profillidis, V.A., "Railway Management & Engineering", Ashgate Publishing Limited, England	2006
3.	Robin H. and Harris, N., "Managing Railway Operations & Maintenance", University of Birmingham Press.	2007
4.	William, H., "Railroad Engineering", John Wiley & Sons.	1982

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 623** Course Title: **Airport Infrastructure**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **NIL**

9. Objective: To impart knowledge about constituent modules of airport infrastructure.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Choosing a system solution, Service configurations, Elements of the air transport system, Future trends,	4
2.	The regulatory environment: The breadth of regulation, National authorities, Service properties, Safety regulations, Security regulations, Environmental regulations	6
3.	Operational environment: Introduction, Evolution, Communication, navigation and surveillance systems, The airborne elements, Future trends	8
4.	Aircraft: Introduction, Costs, Compatibility with the operational infrastructure, Direct and indirect operating costs, balancing efficiency and effectiveness, Effectiveness, The manufacturer's overall remit	8
5.	Airlines: Introduction, Setting up an airline, Modern airline objectives, Route selection and development, Airline fleet planning, Annual utilization and aircraft size, Seating arrangements, Indirect operating costs, Aircraft: buy or lease, Revenue generation, Computerized reservation systems, Yield management, Integrating service quality into the revenue-generation process, Marketing the seats, Airline scheduling, Evaluating success	6
6.	Airports: Introduction, Setting up an airport, airport demand, Airport sitting, Runway characteristics, Runway capacity, Runway pavement strength, The maneuvering area, Aprons, Passenger terminals, Airport demand, capacity and delay.	4
7.	Airspace Management: Introduction, Setting up an air-navigation service provider business, Categories of airspace, Separation minima, Airspace sectors, Capacity, demand and delay, a brief chronology of air traffic control system evaluation, Aerodrome air traffic control equipment and operation, ICAO future air-navigation systems, Air-navigation service providers as businesses	4
8.	Coping With the Future : Environmental accountability, Effects on the business, Financial viability, Statutory compliance, Efficiency, Effectiveness, Airlines' Challenge, Airport's Challenge, Airspace challenge, Systemic Way ahead	2
Total		42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Norman, A. and Wright, P. H., "Airport Engineering", John Wiley & Sons	1992
2.	Khanna, S.K. , Arora, M.G. and Jain, S.S., "Airport Planning & Design", Nemchand & Bros.	2000
3.	Donohue, G. L. "Air Transportation Systems Engineering" AIAA Press	2001
4.	Horonjeff, R. and Mckelvey, F. "Planning & Design of Airports", Tata McGraw Hill.	1993

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CTN– 624** Course Title: **Applied Transport Economics**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory 3 Practical 0**

4. Relative Weight: **CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits ⁴ 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **NIL**

9. Objective: To cater to the need of understanding the economics of transport system and explain the application of a range of techniques.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Dynamics of Transport Market: Demand, Elasticity of demand, the measurement of elasticity, Supply of transport, Elasticity of supply.	5
2.	Costing: Price versus quality, Bus operating cost, Railway costing, Airline costs.	5
3.	Pricing Policy: Price discrimination, Airline pricing, Airline financial performance, Coach pricing, Bus pricing.	8
4.	Cost/Benefit Analysis and Passenger Transport Subsidies: Railway subsidies, cost/benefit analysis, Case studies on bus subsidy.	8
5.	Road Investment: Purpose of investment, Evaluation technique, Transport investment areas, Valuation of time savings.	8
6.	Competition, Regulation and Integration in Public Transport: Need for regulation, Institutional arrangement, Competition in freight market, Competition in taxi trade, Effect on conventional public transport of competition from small vehicles.	8
Total		42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Cole, S. "Applied Transport Economics", Kogan page Limited.	1987
2.	Nash, C.A. "Economics of Public Transport", Longman.	1982
3.	Heggie, I.G. "Transport Engineering Economics", McGraw Hill.	1972
4.	Wohl M. and Hendrickson, C. "Transportation Investment and Pricing Principles", John Wiley & Sons.	1984