

# SCHEME AND SYLLABUS FOR M. Tech. DEGREE PROGRAMME IN CIVIL ENGINEERING

## WITH SPECIALIZATION

TRANSPORTATION ENGINEERING



### **SEMESTER - I**

Course	Subject	Hrs	/ Wee	k	Internal Marks	End Semester Exam.valuation Scheme (Marks)		Credits
110.		L	Т	Р		Marks	Duration (Hrs)	
1MTE01	Pavement Analysis and Design	3	1	0	40	60	3	4
1MTE02	Traffic Engineering I	3	1	0	40	60	3	4
1MTE03	Urban Transportation planning.	3	1	0	40	60	3	4
1MTE04	Applied Probability and Statistics	2	1	0	40	60	3	3
1MTE05	Transportation Eng. Lab I	0	0	2	60	40	0	1
	Total (500)				220	280		21



## **SEMESTER -II**

Course	Subject	Hrs / Week			Internal Marks	End Se Exam.v Scheme	Credits	
110.	L T P		Marks	Duration (Hrs)				
2MTE01	Transportation Systems	3	1	0	40	60	3	4
2MTE02	Transportation Economics	2	1	0	40	60	3	3
2 MTE03	Traffic Engineering II	2	1	0	40	60	3	3
2 MTE04	Bridge Engineering	2	1	0	40	60	3	3
2 MTE05	Transportation Engineering Lab II	0	0	2	60	40	0	1
	Total (500)				220	280		21



## **SEMESTER – III**

Course No.	Subject	Hr	Hrs / Week		Internal Marks	End Semester Exam. valuation Scheme (Marks)		Credits
	L T P		Marks	Duration (Hrs)				
3MTE01	Pavement Materials	2	1	0	40	60	3	3
<b>3MTE02</b>	Advanced Highway Materials	2	1	0	40	60	3	3
3 MTE03	Seminar	0	0	2		100	0	Seminar
3 MTE04	Dissertation Part-I	0	0	2		200		Dissertatio n Part-I
	Total=500				80	420		Total=500



#### SEMESTER - IV

Course No.	Subject	Hrs / Week			Internal Marks	End Semester Exam. valuation Scheme (Marks)		Credits
		L	Т	Р		Marks	Duration (Hrs)	
4MTE01	Dissertation Part-II	0	0	21		400	0	12
	Total (400)					400		12

Total:68



COURSE CO	ODE	COURSE NAME	L-T-P-C	YEAR			
05CE 63	01	PAVEMENT ANALYSIS AND DESIGN	3-1-0-4	2015			
COURSE O	BJECT	IVES:					
• Identi	fy and o	categorize the factors affecting design an	d performanc	e of pavements.			
• To ex	plain th	e basic modelling concepts used to analy	vse flexible an	d rigid paveme	nts.		
• To ex	plain di	fferent design methods for flexible and r	igid pavemen	t design			
COURSE O	UTCO	MES:					
After comple	tion of	the course the student will be able to					
• List a	nd expl	ain the various factors affecting design a	nd performan	ce of pavements	s		
Calcu	late the	stresses and deflection in flexible and right	gid pavements	3			
• Desig	n flexit	ble and rigid pavements					
MODULE		COURSE CONTENT (3	6 hrs)		HRS		
	Ту	pes and Component parts of Paver	nents: Flexil	ole, rigid and			
	ser	ni-rigid pavements Factors affecting d	lesign and pe	erformance of			
	Pa	vements - Influence of environment on p	avement - Fr	ost, Sub grade			
Ι	moisture						
	Su	bgrade: Functions and significance	of subgrade	properties -	-		
	Me	ethods of assessment of subgrade strengt	h - Subgrade	stabilization –			
	W	heel loads – ESWL – EWLF					
		INTERNAL TEST 1(Modu	le 1)				
	An	alysis of Stresses in Flexible Pavement	nts - Empirica	al, Semi			
II	em	pirical and Theoretical Methods of Flu	exible Pavem	ent Design –	9		
	Pro	oblems					
		INTERNAL TEST 2(Modu	le 2)				
	Ri	gid pavement design: Types, Causes a	and Analysis	of Stresses in			
Ш	K1	gid pavements - Types, Functions and S	pacing of Joi	nts in Cement	10		
	Co	ncrete Pavements - Design of Slab Thick	thess and Joir	it Details			
	Pa	vement evaluation and rehabilitation	: surface ch	aracteristics –			
	ski	d resistance – pavement roughness	- paveme	nt distress -	0		
IV	Str	rengthening of existing pavements - Fle	xible and Rig	id Overlays –	8		
	pa	vement maintenance	C	-			
	_	END SEMESTER EXAM (ALL	Modules)				
REFERENC	CES:						



- 1. Yoder and Witezak, "Principles of Pavement Design", John Wiley and sons.
- 2. Yang, Design of functional pavements, McGraw-Hill.
- 3. Kadiyali L.R., "Principles & Practice of Highway Engineering", Khanna Publishers,2003
- 4. Khanna S.K., Justo C.E.G., "Highway Engineering", Nem Chand & Bros., Roorkee, 2001
- 5. IRC: 37-2001, "Guidelines for the Design of Flexible Pavements (Second Revision)".
- 6. IRC: 58-2001, "Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (Second Revision)".
- 7. AASHTO Design of pavement Structures
- 8. Huang Pavement Analysis Elsevier Publication



COURSE O	CODE	COURSE NAME	L-T-P-C	YEAR	2	
05CE 6.	303	TRAFFIC ENGINEERING- I	3-1-0-4	2015		
COURSE (	)BJECT	TIVES:				
• To provid	le an ins	ight on traffic and its components.				
• To expla	in sampl	ling, analysis and interpretation of data of	f various surv	eys		
• To expla	in traffic	e movements, types of intersections, islan	ds, crossings	and their desig	jn.	
• To illust	rate the c	design of signals and explain the redesign	ing of existin	g signals.		
COUDSE O						
COURSE O		VIES:				
After the c		on of the course students should be	nanta factor	offecting	ltroffic	
• Able to	acquire a	and apply knowledge of traffic, its compo	ments, factors	s affecting road	ruarric	
• A blo to	opply the	esign.	ing various a	move and analy	voio	
Aute to     Canable	of desig	ming traffic signals	ing various se	inveys and anar	y 515.	
• To make	of ucsig	dents aware of signal coordination and ro	ad lighting			
MODULE	MODULE COURSE CONTENT (36 hrs)					
MODULL	Introd	uction: Objectives and scope of traffic e	ngineering. (	components of		
	road traffic - the vehicle, driver and road, Road user characteristics: human					
Ι	and ve	chicle characteristics, factors affecting	road traffic	: methods of	9	
	measur	rement. Concepts of passenger car units for	or mixed traff	fic flow.		
	I	INTERNAL TEST 1(Modu	le 1)		<u> </u>	
	Traffic	c Engineering Studies and Analysis: S	Sampling in t	raffic studies;		
	adequa	cy of sample size; application of sam	npling metho	ds for traffic		
	studies	, objectives, traffic surveys, equipmer	nt, data collec	ction, analysis	0	
11	and int	erpretation of (i) Spot speed (ii) Speed	and delay (iii	) Volume (iv)	9	
	Origin	- destination (v) Parking and (vi) Acc	ident studies	, Traffic		
	maneu	vers and Stream Characteristics; applicati	on in intersec	tion design.		
		INTERNAL TEST 2(Modu	le 2)			
	Traffic	c Regulations and Control: General r	egulations: R	egulations on		
ш	Speed,	Vehicles, drivers and flow; other regul	lations and c	ontrol. Traffic	10	
	manage	ement; noise and air pollution due to re	oad traffic an	d methods of	10	
	control	·				
	Traffic	e Control Devices: Traffic signs, mar	kings, islands	s and signals.		
IV	Differe	ent methods of signal design; redesign of	of existing sig	gnal including	8	
	case st	udies. Signal system and co-ordination.	Evaluation a	nd design of	-	
	road lig	ghting.				



- 1. Matson, Smith & Hurd "Traffic Engineerin", McGraw Hill Book Co.
- 2. Kadiyali, L.R. "Traffic Engineering and Transport Planning", Khanna Publishers.
- 3. Wells, G.R. "Traffic Engineering and Hand Book", Institution of Engineers, U.S.A.
- 4. RRL, DSIR Research on Road Traffic', HMSO Publication
- 5. IRC and IS Publications.
- 6. Institute of Transportation Engineers, Manual of Transportation Engineering Studies, Prentice Hall
- 7. Salter, R.J., and N. B. Hounsell, "Highway Traffic Analysis & Design", Mac Millan
- 8. Fred C. Mannering and Walter P Kilaraski, "Principles of Highway Engineering and Traffic Analysis", John Wiley and Sons.
- 9. Kadiyali L.R., "Principles & Practice of Highway Engineering", Khanna Publishers.
- 10. Khanna S.K., Justo C.E.G., "Highway Engineering", Nem Chand & Bros., Roorkee.



COURSE O	CODE	COURSE NAME	L-T-P-C	YEAR			
05CE 6.	305	URBAN TRANSPORTATION PLANNING	3-1-0-4	2015			
COURSE O	<b>)BJEC</b> 1	TVES:					
• To intro	oduce the	e role of planning in analyzing and mode	lling travel de	emand			
• To und	lerstand	the stages involved in the Urban Transpo	ortation Plann	ing process			
• To stu	dy the p	principle of land use transport interaction	on models, it	's mathematica	1		
formu	lation an	d solution					
COURSE C		MES:					
After the co	mpletion	of the course students should be					
• Unders	tand the	various transportation planning concepts	outotion Dlan	ning			
• Unders	iarico the	mathematical travel demand model dev	elonment con	cents and its sol	lutions		
	• Familiarise the mathematical travel demand model development concepts and its solution of the solution of th						
MODULE	Urban	Transportation Problems and P	lanning Pro	cess.Role of	mo		
	transportation and change in concerns of society in transportation planning:						
Т	Transportation problems and problem domain: objectives and constraints:						
	flow ch	hart for transportation planning process.	inventory, m	odel building.	9		
	forecas	ting and evaluation stages	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	8,			
		INTERNAL TEST 1(Modu	le 1)				
	Introdu	ction to Transportation Planning Practic	es. Trip gene	ration models			
т	– Trip	classification - productions and attract	ions – Trip r	ate analysis –	0		
11	Multip	le regression models - Category analysis	s - Trip distri	bution models	9		
	- Grow	th factor models, Gravity model and Op	portunity mod	les.			
		INTERNAL TEST 2(Modu	le 2)				
	Modal	split models - Mode choice behav	ior – Trip	end and trip			
	interch	ange models - Traffic assignment -	Transportatio	n networks –			
Ш	Minim	um Path Algorithms - Assignment m	Assignment methods – All or Nothing 10				
	assignr	nent, Capacity restrained assignment ar	nd Multi path	assignment -			
	Route-	choice behavior.					
	Land u	use and its interaction: Lowry derivativ	ve models - Q	uick response			
IV	techniq	ues - Non-Transport solutions for tran	sport proble	ms. Ekistics -	8		
	Science	e of human settlements - Characteristic	s of urban st	ructure. Town			
	plannin	ig concepts - Neighborhood planning.					



- 1. Hutchinson B G (1974), "Principles of urban transportation system planning", McGraw Hill
- 2. Bruton M J (1981), "Introduction to transportation planning", Hutchinson of London
- 3. Dickey J W (1980), "Metropolitan Transportation Planning", Tata McGraw Hill
- 4. Michael D Mayer and Eric J Miller (1974), "Urban transportation planning A Decision Oriented Approach", McGraw Hill.
- 5. C. S. Papacostas and P.D. Prevedouros (2002), "Transportation Engineering and Planning", Prentice Hall.
- 6. Kanafani, A (1983)., Transportation Demand Analysis, McGraw-Hill



COUDCE C					
COURSEC	ODE COURSE NAME	L-I-P-C	YEAK		
05CE 63	07 APPLIED PROBABILITY AND STATISTICS	2-1-0-3	2015		
COURSE O	BJECTIVES:				
• Expla	in measures of central tendency and different	sampling techn	iques.		
• To illu	ustrate different statistical distributions and the	significance te	st to check goo	dness	
of fit.					
• To ma	ake the students aware of probability theory.				
• To ex	plain regression and correlation and tests of hy	pothesis.			
To ill	ustrate analysis of variance, randomized design	1.			
COURSE O	UTCOMES:				
After the com	pletion of the course students should be				
• Able t	to use appropriate statistical method in transpo	rtation enginee	ring problems		
Capab	ble of applying the rule of probability and discr	ete distribution	s in solving pro	oblems	
Capat	ble of testing the goodness of fit by using statis	tical decision			
Able 1	to apply the knowledge of statistical software i	n analysis of tra	ansportation		
engine	eering problems		•		
MODULE	COURSE CONTENT (32 hrs)				
	Frequency distribution: mean, standard devi	ation, moments	s, skewness		
Ŧ	and kurtosis- definition and applications				
1	Sampling techniques: Simple random samp	ling, stratified	sampling,	8	
	systematic sampling, sample size determination	n- applications			
	INTERNAL TEST 1(Mod	ule 1)		L	
	Statistical distribution: Binomial, Poisson,	uniform, expor	ential and		
	normal distribution, mean and variance. Fitti	ng of the distr	ibutions, Chi-		
п	square test of goodness of fit. Sampling error,	sample size and	d design	8	
	Probability: Laws of probability, conditional	probability and	independent		
	events, Laws of Expectation				
	INTERNAL TEST 2(Mod	ule 2)		1	
	<b>Regression and Correlation:</b> Linear regress	ion and corrlea	ition, multiple		
	correlations. Multiple correlation coefficient	standard erro	r of actimata		
		, standard erro	i oi estimate,		
	analysis of variance,		Students (		
	analysis of variance, Exact Sampling Distributions: Chi-squar Srtedecor''s Edistribution Definitions and an	e distribution	Students t	Q	
ш	analysis of variance, Exact Sampling Distributions: Chi-squar ,Srtedecor''s F distribution, Definitions and ap	e distribution plications	Students t	8	
ш	analysis of variance, <b>Exact Sampling Distributions</b> : Chi-squar ,Srtedecor''s F distribution, Definitions and ap <b>Test of significance</b> : Large samples and so single mean means of two samples prop	e distribution plications nall samples to	Students t	8	
ш	analysis of variance, <b>Exact Sampling Distributions</b> : Chi-squar ,Srtedecor''s F distribution, Definitions and apy <b>Test of significance</b> : Large samples and su single mean, means of two samples, prop observed correlation coefficients (Fichers z tr	e distribution, plications nall samples to ortions, two wansformations)	Students t ests, Test for rariances, two Paired T	8	



IV       Confidence interval: Interval for mean, variance and regression       coefficients         Design Experiments:       Analysis of variance, statistical principle of       Statistical principle of	8
experimentation, Basic designs, completely randomized blocks,	

#### **REFERENCES:**

- 1. Gupta.S.C. and Kapoor.V.K, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 1978.
- 2. Benjamin, Jack.R and Comell.C, Allin, Probability, Statistics and Decision for Civil Engineers, Mc-Graw Hill.
- 3. Kadiyali.L.R, Traffic Engineering and Transport Planning, Khanna Publishers.
- 4. Wohl, Martin and Martin, Brian. V, Traffic Systems analysis for Engineers and Planners, Mc-Graw Hill.
- 5. Richard.A. Johnson: Miller and Freunds, Probability and Statistics for Engineers (6 edition) Pearson.



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COUDCE		COUDSE NAME	LTDC	VEAD		
COURSEC	ODE	COURSE NAME	L-I-P-C	YEAR		
CETE1	1	HIGHWAY GEOMETRIC DESIGN	2-1-0-3	2015		
COURSE O	BJECT	TIVES:				
• To ex	kplain th	e basic concepts of traffic Engineering.				
• To de	etermine	e the cross section elements of the pavement	ent.			
• To de	esign the	e horizontal and vertical alignment of hig	hways.			
• To ex	kplain th	e different types of intersections and part	king.			
COURSE O	UTCO	MES:				
After the cor	npletion	of the course students should be able				
• To ge	et an ide	a of traffic engineering				
• To de	esign the	e various cross section elements.				
• To de	esign the	e horizontal and vertical alignment of hig	hways.			
• To m	ake the	students aware of design of different type	es of intersect	ions		
MODULE		COURSE CONTENT (3	2hrs)		HRS	
	Basic	concepts of Traffic Engineering: Obje	ectives and re	quirements of		
	highway geometric design, highway classification, terrain classification,					
I	importance of traffic data in geometric design, design hour volume,					
	directional distribution of traffic, traffic composition, traffic forecasting,					
	design	vehicle, design speed, highway capacity	, level of serv	ice.		
		INTERNAL TEST 1(Modu	le 1)			
	Cross	Section Elements: Right of way	and width c	considerations,		
	roadw	ay, shoulders, kerbs, camber, side s	lope, lateral	and vertical		
II	clearai	nce, control of access, traffic barriers,	medians, fr	ontage roads,	8	
	Pavem	nent surface characteristics - types, cross	slope, skid re	esistance,		
	unever	nness.				
		INTERNAL TEST 2(Modu	le 2)			
	Horiz	ontal and Vertical Alignments: Sight	distances - ty	pes, analysis,		
	factors	s affecting, measurements, Horizon	tal alignme	nt - design		
ш	consid	erations, stability at curves, super elev	ation, widen	ing, transition	8	
	curves	; curvature at intersections, vertical a	lignment - g	rades, ramps,		
	design	of summit and valley curves, design of e	expressways,	IRC standards		
	and gu	idelines for design problems.				
	Desig	n of Intersections: Characteristics and c	tesign consid	erations of at-		
IV	grade	intersections; Different types of island	us, channeliz	ation; median	8	
	interch	anges - types, warrants, adaptabil	lity and de	esign details;		



Approved by Govt. of Rajasthan vide Sunrise University Act, 2011 Recognized by UGC Act, 1956 u/s 2 (f)

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Interchanges - different types, ramps. **Design of Parking lots**- Factors, design elements, different types of parking, design of ramps and other elements of multistoried parking lots.

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#### END SEMESTER EXAM (ALL Modules)

- 1. AASHTO, A Policy on Geometric Design of Highways and Streets', American Association of State Highway and Transportation Officials, Washington D.C.
- 2. Khanna S.K. and Justo, C.E.G., Highway Engineering', Nem Chand and Bros.
- 3. DSIR, Roads in Urban Areas', HMSO, London.
- 4. Jack E Leish and Associates, Planning and Design Guide: At-Grade Intersections. Illinios.
- 5. IRC: 86-1983, IRC: 52- 1973, IRC: 64-1990, IRC: 3-1984, IRC: 38-1988, IRC:66-1976, IRC: 65-1976, IRC: 92-1985, IRC: 103-1988, IRC SP: 41
- 6. Kadiyali, L.R., Principles & Practice of Highway Engineering, Khanna Publishers, 2003
- 7. Kadiyali, L.R. Traffic Engineering and Transport Planning, Khanna Publishers.



COURSE (	CODE	COURSE NAME	L-T-P-C	YEAR	2			
CETE1	3	INTELLIGENT TRANSPORTATION SYSTEMS	2-1-0-3	2-1-0-3 2015				
COURSE (	<b>)BJEC</b>	TIVES:						
• Lear	n the obj	jectives, benefits and the telecommunicat	ions in ITS.					
• Lear	n about	the functional areas, user needs and servio	ces in ITS.					
• Lear	n the co	ncepts of ITS operations and applications						
COURSE (	DUTCO	MES:						
After the co	mpletion	n of the course students should be						
Able	e to appro	eciate the advantages of ITS and suggest	the appropria	te technologies	for			
field	conditio	ons.						
• Able	to sugg	est the appropriate system/s in various fu	nctional areas	of transportation	on.			
Able	e to amal	gamate the various systems, plan and imp	plement the ap	oplications of I	ГS.			
MODULE		COURSE CONTENT (3	2 hrs)		HRS			
	History	y of ITS, ITS – Need, Standards and p	olicy, Systen	n architecture,				
	ITS Developments –Worldwide and Indian scenario, Metropolitan and							
Ŧ	Rural I	TS, ITS policy issues. ITS user services:						
I	Troffic	Management conters Types and fun	ations Trava	l and traffic	8			
	manag	ament Public transportation operation	Cuoils, Have	roial vehicle				
	operati	ons Advanced Traveler Information syst	rems	iciai venicie				
	operati							
		INTERNAL TEST I(MOdu	le 1)					
	Pre tri	p and En route information, Data co	llection tech	niques, Route				
II	Guidar	nce Systems, Infrastructure based syst	ems and its	applications,	8			
	Variab	le message signs, Vehicle to Center and	Vehicle to I	Roadside				
	commi							
	Applia	ation of ITS : Insident Managemen	le 2)	managamant	[			
	Flectro	ation of 115. Incident Management	IL-, Farking	management,				
	Ramn	metering Dynamic speed adaptation	Advanced 1	raffic control				
	system	s In-vehicle systems Dynamic routing/s	cheduling IT	S Design: ITS				
III	system	design-components and requirements at	nd Evaluation	ITS for road	8			
	networ	k- System Design Sensor technologies	and data rec	wirements for				
	ITS. Pe	ositioning systems in ITS. Mobile phone	location and	its impact on				
	ITS. Te	elecommunication in ITS, Application of	GIS in ITS.	1				



IV	Automated Highway Systems: Evolution of AHS and new trends, Smart cars, Vehicle in platoons, Integration of AHS, System configuration, Implementation of AHS,communication technologies for AHS, Control and sensor requirements in AHS,Effect of AHS on environment. Transportation planning and ITS: - Relationships between problems, conventional approach and ITS approach. (Case studies), Operations and fleet management, Emergency management systems, Collision warning systems. Possibilities of ITS in India and Future of ITS.	8
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- 1. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
- 2. Roger R. Stough, "Intelligent Transport Systems Cases and Policies", Publisher: Edward Elgar, 2001.
- 3. Chris Drane and Chris Rizos, "Positioning Systems in Intelligent Transportation Systems", Artech House Publishers, London
- 4. Joseph M. Sussman, "Perspectives on Intelligent Transport Systems", Springer Publishers.



COURSE O	CODE	COURSE NAME	L-T-P-C	YEAR		
CETE1	TE15 TRANSPORTATION SYSTEM 2-1-0-3 2015 MANAGEMENT		2015			
COURSE (	)BJECT	TVES:				
• To ii	ntroduce	the present day transportation problems				
• To f	amiliariz	ze various transportation system manager	nent techniqu	les		
• To f	familiariz	ze various transportation demand manage	ement techniq	ues		
COURSE (	DUTCO	MES:				
• Unde	erstandth	evariousconcepts of transportation syste	m manageme	nt without capa	city	
augn	nentatior	1				
• Kno	wledge	of Transportation Demand Management				
• Fam	iliarizeth	nemethods to improve the traffic operation	IS		~	
MODULE	COURSE CONTENT (32 hrs)				HRS	
	Present Transportation Problems – Transportation System Management					
	TSM Actions: TSM actions, issues addressed applications, implementation					
	problems, evaluation and benefits					
I	Public transportation & HOV priority - park and ride car pooling					
	exclusive lanes priority at ramp terminals bus transfer stations					
	guaranteed ride home, commuter financial incentives, shared ride -Dial a					
	ride for elderly & handicapped.					
	<u>I</u>	INTERNAL TEST 1(Modu	le 1)			
	Demar	d Management: Staggered work hour	s, flexible wo	ork hours,		
II	telewor	k, high peak period tolls, shuttle service	s, circulation	services, road	8	
	pricing	. New Urbanism				
		INTERNAL TEST 2(Modu	le 2)			
	Traffic	c Operations Improvement: On-street	parking ban,	freeway ramp		
Ш	control	& closure, travel on shoulders, one-wa	ay streets, re-	versible lanes,	Q	
ш	traffic	calming, Right turn phase, right turn la	nes, reroute t	urning traffic,	0	
	Traffic	signal co ordination and Optimization				
	Parkin	g Management: Short term reserved	parking, incr	eased parking		
IV	rates, t	ime duration limits, expanded off-stree	et parking N	on Motorized	8	
	Transp	ort: pedestrian only streets, exclusive cvc	le paths			



- 1) D, Arlington, Transportation System Management in 1980: State of the Art and Future Directions, Transportation Research Board, 1980.
- 2) Institute of Transportation Engineers, Transportation and Traffic Engg. Hand Book, Prentice Hall, 1982
- 3) TRB Publications.



COURSE O	CODE	COURSE NAME	L-T-P-C	C YEAR	
05CE 6.	377	RESEARCH METHODOLOGY	1-1-0-2	2015	
COURSE OBJECTIVES:					
• To g	enerate a	awareness about the importance, types an	d stages of re	search along	
• To u	nderstan	d different methods for data collection, a	nalysis interp	retation and	
prese	entation	of the results.			
COURSE (	DUTCO	MES:			
The students	s will be	able to understand			
• The	significa	nce of different types of research and its	various stage	5	
• The	different	methods for data collection			
• Diffe	erent me	thods for analyzing data and interpreting	the results		
• The	proper w	vay of reporting and presenting the outcom	me		
MODULE		COURSE CONTENT (1	8hrs)		HRS
	Introdu	iction to research methodology. Types of	research, res	earch methods	
	Vs met	thodology - stages of research process. I	Literature revi	ew – Problem	
Ι	I definition- Research design for exploratory, descriptive and experimental				4
	research – Brief introduction to completely randomized design,				
	random	nized block design and Latin square design	gns (descriptio	on only).	
		INTERNAL TEST 1(Modu	le 1)		
	Sampli	ng fundamentals -Types of samplin	ıg: probabili	ty and non-	
	probab	ility sampling. Sampling theory, sampli	ng distributio	on and sample	
	size de	termination. Tools and techniques of dat	ta collection:	Questionnaire	
II	and so	chedule for field surveys, interview,	, observatior	, simulation,	4
	experir	nental and case study methods. Colle	ection, record	ling, editing,	
	coding	and scaling of data. Scale classification	and types. M	easurement of	
	validity	y, reliability and practicality.	1- 7)		
	Deceri	INTERNAL TEST 2(Modu	le 2)	tamanatatian	
	Descript	of hypothesis, testing of population may	alysis and in	nd propertion	
III	7 test	t test E test chi square test Test fo	n, variance a	and regression	6
	-z iest	ard error of the estimate. Testing goodness	s of fit	ind regression	
-	Meanir	of interpretation and inference:	importance	and care for	
	interpre	eting results. Presentation of reports: po	pular reports	and technical	
	reports	- structure and style. Oral and written	n presentation	ns: Parts of a	
IV	researc	h report. Guidelines for writing resea	arch papers a	and reports –	4
	Writing Results	g different sections of a research paper –	Introduction,	Methodology, Methods of	
	giving	references and appendices: referencing	styles. Ethic	s in research.	
	Use of	computers and internet in research.	J		



#### INTERNAL TEST 3 (Modules 3 and 4

- 1. C. R. Kothari, Research Methodology, Methods and techniques (New Age International Publishers, New Delhi, 2004).
- 2. R. Panneerseklvam, Research Methodology (Prentice Hall of India, New Delhi, 2011).
- 3. Ranjit Kumar, Research Methodology, A step by step approach (Pearson Publishers, New Delhi, 2005.
- 4. Management Research Methodology : K. N. Krishnaswami, Appa Iyer and M Mathirajan, Pearson Education, Delhi, 2010
- 5. Hand Book of Research Methodology : M N Borse, Sree Nivas Publications, Jaipur, 2004
- 6. Business Research Methods: William G Zikmund, South Western Ltd, 2003
- 7. Research Methods in Social Science: P K Majumdar, Viva Books Pvt Ltd, New Delhi, 2005
- 8. Analyzing Quantitative Data: Norman Blaikie, SAGE Publications , London, 2003
- 9. SPSS for Windows: Pearson Education New Delhi, 2007



COURSE CODE	COURSE NAME	I_T_P_C	VFAD			
COURSE CODE		L-I-F-C	ILAN			
05CE (201	TRANSPORTATION	0.0.2.1	2015			
05CE 0391	ENGINEERING LAB-I	0-0-2-1	2015			
-						
COURSE OBJECT	TIVES:					
• To explain th	e properties of aggregates and their tests					
• To explain th	e various tests on bitumen.					
• To illustrate	Rothfutch method of marshal mix design					
• To determine	e strength characteristics of subgrade soil					
• To make the	students aware of pavement evaluation to	echniques.				
COURSE OUTCO	MES:					
After the completio	n of the course students should be					
• Able to test t	he aggregates.					
• Able to test n	eat and modified bitumen					
• Qualified to a	design bituminous mix Rothfutch method	d of marshal n	nix design.			
• Capable of an	• Capable of analyzing the strength of soil by conducting CBR test					
• Able to analyze the surface characteristics of pavement.						
Tests on sub grade soil, aggregates, bitumen, modified binders - Pavement evaluation – skid						
resistance and roughness measurements, deflection measurement.						
Mix Design: Granula	ar Sub-base, Bituminous – DBM, SDBC,	BC, etc., Cer	nent concrete.			



COURSE (	CODE	COURSE NAME	L-T-P-C	YEAR			
05CE 6302		TRANSPORTATION SYSTEMS	3-1-0-4	2015			
COURSE OBJECTIVES:							
• To ex	xplain th	e various modes of transportation with t	their relative m	erits and demer	its		
• To m	ake the	students aware of the development of r	ailways, mode	rn trends in air			
trans	portation	l.					
• To ex	xplain th	e factors affecting development of harb	ours and ports	and elements in	L		
harbo	our and p	ort planning					
• To n	hake the	students aware of national waterway	s and pipeline	e transportation	in the		
count	try with	their important characteristics					
• To ex	xplain th	e need of urban mass transportation in o	leveloping cou	ntries and comp	pare the		
vario	us mode	s of urban mass transportation systems					
COURSE O	UTCON	MES:					
After compl	etion of	this course the student will be able					
• To ex	kplain an	d compare the various modes of transp	ortation with the	neir relative me	rits and		
deme	erits						
• List a	and discu	iss the factors affecting development of	harbours and p	orts.			
• List chara	the varient	ous national waterways in the country s.	y and explain	their importan	t		
<ul> <li>Expla</li> </ul>	ain the n	eed of urban mass transportation in de	eveloping cour	ntries and comp	are the		
vario	us mode	es of urban mass transportation systems					
MODULE		COURSE CONTENT (	(36 hrs)		HRS		
	Introd	uction– Importance of transporta	ation systems	– Historical			
	develo	pment of transport in India- Road d	levelopment p	lans, National			
Ι	Transp	ort Policy Recommendations, Vision	2021, NHDP,	PMGSY-IRC	9		
	and CF	RRI. Characteristics of different modes	of transport, th	eir integration			
	and int	eraction, impact on environment.					
		INTERNAL TEST 1(Mod	ule 1)				
	Railwa	ys systems- Role of railways in tra	ansportation, A	Advantages of			
п	railway	vs, Indian railways, classification, p	resent scenari	o of railway	Q		
	develo	pment in India, Modernization of railwa	ays, developme	ent of high and			
	super h	igh speed railways.					



INTERNAL TEST 2(Module 2)				
	<b>Airports</b> Overview of air transportation, Role of FAA and ICAO, air transport in India, types of airports, Heliports, STOL ports, complexities in			
ш	airport planning, elements of airport planning, airport master plan,	10		
111	Harbours and Ports –Development of harbours and ports in India,	10		
	Harbour infrastructure-port facilities, Containerization, Inland waterways and their characteristics. Pipeline transportation.			
	Urban transportation systems –Importance of collective transportation			
	v/s individual transportation, freight transportation, Physical system			
IV	components of urban transportation, Overview of Mass rapid transit, Light	8		
	rail transit, Personal rapid transit, guided way systems, Para transit			
	systems, Metro rail, Mono rail, bus rapid transit systems.			
END SEMESTER EXAM (ALL Modules)				

- 1. Khanna, Arora and Jain, Airport planning and design, Nem Chand and Bros., Roorkee.
- 2. H P Oza and G H Oza, Docks and Harbour Engineering, Charotar Publishing House.
- 3. Alan Black, Urban Mass Transportation Planning, McGraw-Hill, 1995.
- 4. Khanna, S.K., Justo, C.E.G., and Veeraragavan, A., `Highway Engineering", NemChandandBros, Roorkee
- 5. S.C.Saxena and S.P.Arora "A text book of Railway Engineering", Dhanpat Rai publications



COURSE CODE	1	COURSE NAME	L-T-P-C	YE	AR
CETE04		TRANSPORTATION ECONOMICS	2-1-0-3	2015	
<ul> <li>To provide s</li> <li>Identification</li> </ul>	solid nofv	<b>VES:</b> introduction to demand and cost analyses. variouscostsandbenefitsassociatedwithhighv	vayconstruct	ion,mainter	nance
<ul> <li>, operations</li> <li>To introduction</li> <li>various met</li> <li>Introduction</li> </ul>	etc. e the hods to the	various concepts of generation and screeni of economic analysis. ne fundamentals of financing and funding fo	ng of project r transportati	s and on projects	
<ul> <li>COURSE OUTC</li> <li>Understand</li> <li>Understand</li> <li>its monetary evaluation</li> </ul>	OMI Ithep I the aluat	ES: principleofeconomicsanditsapplicationintrar benefits and costs associated with various t ion	sportation ransport proj	jects and	
• Familiarization with the application of various methods of economic analysis and their comparison.					S
MODULE		COURSE CONTENT (32 h	irs)		HRS
Ι	Intro trans time surpl acco socia socia	oduction: Need for economic evaluation, port project, time horizon, basic princip value of money, Supply and demand lus and social surplus criteria, framework unting rate of interest, social opportunity al time preference rate of interest, accountin ices.	costs and b les, interest Models, Co of social ac cost, rate o ag prices of g	enefits of rate, and onsumer's counting: f interest, goods and	8
		INTERNAL TEST 1(Module 1	)		
II	Bend Redu of ir redu noise incre Tran main acco	efits due to Transport Improvement aced vehicle operation costs, value of trave acreased comfort and convenience, cost of ction in maintenance cost; negative bene e and air pollution. Indirect Benefits: In eased development and demand. <b>Insport Costs:</b> Fixed and Variable costs, attenance cost and other related costs, cost unting for inflation, theory of transport s	ts: Direct el time savin of accident n efits due to acreased lan cost of imput estimating upply and n	Benefits: gs, value reduction, increased d values, rovement, methods, road	8
	e min	INTEDNAL TEST 2(Madrala 2	<b>`</b>		



	Economic Analysis: The generation and screening of project ideas.	
	Different methods of economic analysis - Annual cost and benefit	
III	ratio methods, discounted cash flow method, determination of IRR	8
	and NPV. Examples of economic analysis, application economic	
	theory in traffic assignment problem.	
	Financing: Economic analysis of projects - Financing of road	
IV	projects - methods - Private Public Partnership (PPP) - Toll	0
	collection - Economic viability of Build- Operate-Transfer Schemes	0
	– Risk Analysis - Case Studies.	

- 1. Winfrey R, "Highway Economic Analysis", International Textbook Company.
- 2. Kenneth J. Button, "Transport Economics", Edward Elgar Publishing
- 3. David A. Hensher, Ann M. Brewer, "Transport: An Economics and Management Perspective", Oxford University Press
- 4. Emile Quinet, Roger Vickerman, "Principles of Transport Economics", Edward Elgar Publishing
- 5. Road User Cost Study, Central Road Research Institute
- 6. Ian G. Heggie, Transportation Engineering Economics, McGraw Hill.
- 7. IRC: SP: 30-1993, Manual on Economic Evaluation of Highway Projects in India
- 8. Kadiyali L.R., "Principles & Practice of Highway Engineering", Khanna Publishers, 2003
- 9. Khanna S.K., Justo C.E.G., "Highway Engineering", Nem Chand & Bros., Roorkee, 2001
- 10. Woods, K.B., Berry, D.S. and Goetz, W.H., `Highway Engineering', McGraw Hill Book Co.



COURSE CODE	COURSE NAME	L-T-P-C	YEAR	
05CE 6306	TRAFFIC ENGINEERING II	2-1-0-3	2015	
COURSE OBJECTIVES:				

- To learn the principles of traffic forecasting.
- To learn the concept of design vehicle and design volume to be considered along with the Concept of roadway capacity and level of service.
- To explain the importance of highway capacity and accident analysis.
- To make the students aware of simulation and its applications in traffic engineering.

#### **COURSE OUTCOMES:**

After the completion of the course students should be

- Able to learn the principles of traffic forecasting.
- Able to estimate the capacities of roadways and intersections and the prevailing level of service.
- Able to explain the concepts of traffic flow theory and the probabilistic approach in traffic engineering.
- Able to apply simulation techniques traffic engineering.

MODULE	COURSE CONTENT (32 hrs)	HRS		
I	<ul> <li>Traffic Forecast: General travel forecasting principles, different methods of traffic forecast - Mechanical and analytical methods, Demand relationships</li> <li>Design Hourly Volume for Varying Demand Conditions: Concept of Design vehicle units and determination of PCU under mixed traffic conditions, Price-volume relationships, and demand functions. Determination of design hourly volume; critical hour concept.</li> </ul>			
INTERNAL TEST 1(Module 1)				
Π	<b>Highway Capacity:</b> Factors affecting capacity, level of service; Capacity studies - Capacity of different highway facilities including unsignalised and signalized intersections. Problems in Mixed Traffic flow; Case studies. <b>Accident Analysis:</b> Analysis of individual accidents and statistical data; Methods of representing accident rate; Factors in traffic accidents; influence of roadway and traffic conditions on traffic safety; accident coefficients; Driver strains due to roadway and traffic conditions.	8		



INTERNAL TEST 2(Module 2)					
III	Traffic Flow Theory: Fundamental flow relationship and their				
	applications, Traffic flow theories and applications; Shock waves; Queuing				
	theory and applications.				
	Probabilistic Aspects of Traffic Flow: Vehicle arrivals, distribution				
	models, gaps and headway distribution models; gap acceptance merging				
	parameters, delay models, applications.				
	Simulation: Fundamental principle, application of simulation techniques				
	in traffic engineering, general simulation process, formulation of				
<b>TX</b> 7	simulation models, physical, analog and symbolic models, measure of				
IV	effectiveness, analytical, numerical and Monte Carlo techniques,				
	representation and scanning, physical and memorandum, comparison,				
	applications.				
END SEMESTED EVAM (ALL Modulos)					

- 1. Babkov, V.F. "Road conditions and Traffic Safety", MIR publications, 1975.
- 2. Kadiyali, L.R., "Traffic Engineering and Transport Planning", Khanna Publications.
- 3. Drew, D.R., "Traffic Flow Theory and Control", McGraw Hill Book Co.
- 4. Wohl and Martin, "Traffic Systems Analysis for Engineers and Planners", McGraw Hill Book Co.
- 5. Pignataro, Louis, "Traffic Engineering Theory and Practice", John Wiley.
- 6. Barenbag, `Traffic Flow Theory' Monograph
- 7. Jerry Banks, John S. Carson II, Bary L. Nelson, David M Nicol, "Discrete event system Simulation", PHI India



COURSE CODE	COURSE NAME	L-T-P-C	YEAR	
CETE22	ENVIRONMENTAL IMPACT ASSESSMENT	2-1-0-3	2015	
COURSE OBJECTIVES:				

#### COURSE OBJECTIVES:

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

#### **COURSE OUTCOMES:**

After completion of the course the student will able to

- To describe the environmental imbalances, indicators and explain the concept of EIA
- To identify and describe elements to be affected by the proposed developments and/or likely to cause adverse impacts to the proposed project, including natural and manmade environment;
- To assess the impacts of various development on environment
- To summarise the methodologies for carrying out environmental impact assessment

MODULE	COURSE CONTENT (32 hrs)	HRS		
I	Introduction: Concepts of environmental impact analysis, key features of National environmental policy act and its implementation, screening in the EIA process, utility and scope of EIA process, Environmental protection acts EIA at national level. Conceptual approach for environmental impact studies, planning and management of impact studies, matrix and network methodologies for impact identification, description of the affected environmental – environmental indices.	8		
INTERNAL TEST 1(Module 1)				
II	Prediction and Assessment of Impact on Air Environment: Basic information on air quality, sources of air pollutants, effects of air pollutants, key legislations and regulations, conceptual approach for addressing air environment impacts, impact prediction approaches, assessment of significance of impacts, identification and incorporation of mitigation measures.	8		



#### **INTERNAL TEST 2(Module 2)**

	INTERNAL TEST 2(Would 2)	
	Prediction & Assessment of Impact on Noise & Social Environment: Basic	
III IV	information on noise, key legislation and guidelines, conceptual approach	
	for addressing noise environment impacts, impact prediction methods,	
	assessment of significance of impacts, identification and incorporation of	8
	mitigation measures Conceptual approach for addressing socio-economic	
	impacts, traffic and transportation system impacts, visual impacts, scoring	
	methodologies for visual impact analysis	
	Decision Methods for Evaluation of Alternatives: Conceptual basis for	
	trade-off analysis, weighting of decision factors, scaling, rating or ranking	
	of alternatives, development of decision matrix.	
	Public participation in environmental decision making: Regulatory	0
	requirements, advantages and disadvantages, environmental impact	8
	assessment process, objectives of public participation, selection of public	
	participation techniques, techniques for conflict management and dispute	
	resolution, verbal communication in EIA studies.	
	END SEMESTER EXAM (ALL Modules	

- 1. CANTER, L.W., Environmental impact assessment, McGraw-Hill, 1997
- 2. Betty Bowers Marriott, Environmental Impact Assessment: A Practical Guide, McGraw-Hill Professional, 1997.
- 3. Peter Morris & Riki Therivel, Methods of Environmental Impact Assessment, Routledge, 2001.
- 4. Denver Tolliver, Highway Impact Assessment, Greenwood Publishing Group, 1993.
- 5. R. K. Jain, L. V. Urban, G. S. Stacey, H. E. Balbach, Environmental Assessment, McGraw-Hill Professional, 2001.



COURSE C	CODE	COURSE NAME	L-T-P-C	YEAR	-
05CE 63	5CE 6324 OPTIMISATION TECHNIQUES 2-1-0-3 2015				
COURSE C	)BJECT	TIVES:			
• 1	o study	fundamentals of linear programming.			
• To get an idea of advanced linear programming.					
• 1	o make	the students aware of dynamic programm	ning and game	e theory.	
• 1	To study	the basics of network models.			
COURSE C	DUTCO	MES:			
After the con	mpletion	of the course students should be			
• A	Able to st	tudy fundamentals of linear programming	<u>g</u> .		
• A	Able to st	tudy advanced linear programming.			
• Able to apply the concepts of dynamic programming and game theory in					
transportation problems.					
• (	capable o	of using network models in traffic engine	ering.		UDC
MODULE	<b>F</b> 1	COURSE CONTENT (3)	$\frac{2 \text{ hrs}}{1}$		HRS
	Elemer	itary Linear Programming: Systems	of linear	equations &	
т	programming problems - Theory of Simplex method – Simplex Algorithm – Charne''s M-Method – Two phase method – Duality in linear				
I					8
programming – Dual Simplex method					
INTERNAL TEST 1(Module 1)					
	Advise	ad Linear Dramming Consitiuit		Donom otri o	[
	Advand	ming Rounded Veriables problem	Trononortati	- Parametric	
п	Integra	lity property MODI method Degener	acy Unbala	nced problem	8
ш	$-\Delta ssi$	anment Problem – Development of Hu	acy – Olioala ngarian meth	od – Routing	0
	probler	n.	ingarian meth	ou Routing	
INTERNAL TEST 2(Module 2)					
	Dynam	ic Programming and Game Theor	y: Nature	of Dynamic	
	Program	mming problem – Bellman"s optimality	y principle. (	Cargo loading	
III	probler	n – Replacement problem – Multistage	e production	planning and	8
	allocati	ion problem – Rectangular Games – $1$ we and mixed strategies – 2 x n and mix	) person – ze 2 games Rel	ro sum games	
	theory	of games and linear programming $2 \times 10^{-10}$	2 games. Rei	ation between	
	Networ	rk Path Models: Tree Networks – M	linimal Spar	nning Tree –	
	Kruska	l"s Algorithm ,Prim"s Algorithm- Shorte	st path proble	ems – Solution	0
IV	method	ls – Dijkstra"s Method – Floyd"s Algor	ithm – Netwo	ork flow	8
	Fulkers	son	ne metnod	of Ford and	
	TUIKUI	3011			



- 1. Bazarra M. S. Jarvis J. J, H. D. Sherali-Linear programming and Network flows John Wiley, II edition, 1990.
- 2. Bazarra M. S. Sherali. H. D, & Shetty. C. M. Nonlinear Programming Theory and Algorithms John Wiley, II edition, 1993.
- 3. Hadley. G. Linear Programming, Narosa Publishing House, 1990.
- 4. Hillier F. S & Liebermann G. T. Introduction to OR. Mc. Grand Hill, VII edition, 2010
- 5. Taha. H. A. Operations Research An introduction, Prentice Hall, India, VI edition, 1999.



COURSE C	COURSE CODECOURSE NAMEL-T-P-CYEAR				
05CE 63	326	TRAFFIC FLOW THEORY	2-1-0-3	2015	
<ul> <li>COURSE OBJECTIVES:</li> <li>To learn the relationships between the parameters of traffic flow and the types of f theories.</li> <li>To study stream characteristics of traffic using distributions.</li> <li>To learn the concept of design vehicle and design volume to be considered along v Concept of roadway capacity and level of service.</li> <li>To study the fundamentals of queuing theory relevant to traffic engineering.</li> <li>Learn the probabilistic aspects of vehicle arrivals, gap acceptance and delays.</li> <li>Learn the principles of traffic forecasting and simulation in traffic engineering.</li> </ul>					low with the
<ul> <li>COURSE OUTCOMES:</li> <li>After the completion of the course students should be <ul> <li>Able to apply the flow theories to field situations such as toll booths, diversion means etc.</li> <li>Able to estimate the capacities of roadways and intersections and the prevailing level service.</li> <li>Able to apply the concepts of vehicle arrivals to field situations such as exit ramps ramps etc.</li> </ul> </li> </ul>					asures vel of , entry
• Able	to appre	COURSE CONTENT (3	$\frac{10 \text{ simulation}}{2 \text{ hrs}}$		HRS
I	Traffi Measu Charac Use o Vehicl Distrib Traffi Flow-0 Analog like B linear	c stream characteristics and Descrip rement, Microscopic and Macroscopic cteristics Goodness of Fit Tests - Flow of counting, Interval and Translated D le Arrivals, Headways, Speeds, Gap outions c Stream Models: Fundamental Equati Concentration Relationships, Normalized gy Approach, shock Wave Theory, Plato ehaviour of Traffic Flow, Car-Followin Car Following Models, Acceleration Noi	ption using study of T study of T stributions f os and Lag on of Traffic d relationship on Diffusion g Theory, Li se	distributions: Traffic Stream concentration; For describing s; Fitting of flow, Speed- s, Fluid Flow and Boltzman near and Non	8
		INTERNAL TEST 1(Modu	le 1)		
II	Queui Charac Model Pedest	ing Analysis: Fundamentals of Queuing cteristics, Deterministic Queuing Mo s, Multiple Service Channels, Models of rian Crossings	g Theory, De dels, Stocha f Delay at Inte	mand Service stic Queuing ersections and	8



INTERNAL TEST 2(Module 2)					
	Highway Capacity and Level- of - Service Studies: Concepts, Factors				
III	affecting Capacity and Level of Service, Capacity Analysis of Different	8			
	Highway Facilities, Passenger Car Units, Problems in Mixed Traffic Flow				
	Simulation Models : Philosophy of Simulation Modelling, Formulation				
	of Simulation Model, Methodology of System Simulation, Simulation				
	Languages, Generation of Random Numbers, Generation of Inputs-				
IV	Vehicle Arrivals, Vehicle Characteristics, Road Geometrics, Design of	8			
	computer Simulation Experiments, Analysis of Simulation Data,				
	Formulation of Simulation Problems in Traffic Engineering and				
	Validation.				
	END SEMESTER EXAM (ALL Modules)				

- 1. TRB-SR No.165-Traffic Flow Theory, Transportation Research Board, Washington-D.C.
- 2. May, A.D, Traffic Flow Fundamentals, Prentice-Hall, NJ
- 3. Drew D.R, Traffic Flow Theory and Control, McGraw-Hill, New York.
- 4. TRB Special Report 209: Highway Capacity Manual, Transportation Research Board, Washington DC,1985.
- 5. Wohl M. and Martin, B.V., "Traffic System Analysis for Engineers and Planners", McGraw-Hill, New York.
- 6. McShane W R & Roess R P, "Traffic Engineering", Prentice-Hall, NJ
- Mannering F.L & Kilareski, W.P., "Principles of Highway Engineering and Traffic Analysis", John Wiley & Sons. Neylor, T. H et al., "Computer Simulation Techniques", John Wiley.



COURSE O	CODE	COURSE NAME	L-T-P-C	YEAR	2
CETE3	CETE32 BRIDGE ENGINEERING 2-1-0-3 2015				
<ul> <li>COURSE OBJECTIVES:</li> <li>To make students to learn principles of Structural Design,</li> <li>It provides the foundation for advanced design and bridge analysis and design.</li> <li>To evaluate performances of the structures.</li> <li>COURSE OUTCOMES:</li> <li>On completion of this course, students are able to</li> <li>Understand and use the basic concepts in proportioning and design of bridges in tera aesthetics, geographical location and functionality.</li> <li>Develop an intuitive feeling about the sizing of bridge elements and the conc design part</li> <li>Assess the load flow mechanism and loads on bridges.</li> <li>Design of bridge and its foundation starting from conceptual design, selecting su bridge geometry to sizing of its elements</li> </ul>					erms of ceptual suitable
	<u> </u>	letty to sizing of its elements			
MODULE	ODULE         COURSE CONTENT (32 hrs)				HRS
I	report- loading	<b>ing of bridges:</b> Investigation for bridg on of site- economical span- subsoil - importance for proper investigation-De g- types of bridges- components of brid idges and box culvert.	es- need for exploration- esign of RCC ges- analysis	investigation– investigation bridges– IRC and design of	8
INTERNAL TEST 1(Module 1)					
П	Design slab, lo method concret	of girder bridges:- T-beam bridges- A ongitudinal girders and cross girders-Pig d- Morice and Little method- Hendry te bridges( simply supported case only).	Analysis and o eaud"s metho Jaegar metho	lesign of deck d– Courbon"s 1– prestressed	8
		INTERNAL TEST 2(Modu	le 2)		1
ш	Bearin for gire Substru substru founda	<b>ngs:</b> – importance of bearings– bearings der bridges–Design of elastomeric bearin ucture- different types- materials for icture design– piers and abutments – sh ition.	for slab brid ngs –Joints –A or piers an allow footing	ges– bearings appurtenances. d abutments- s – well	9
IV	Constr bridges of failu bridges	ruction methods: – Inspection and main s-case studies of recently constructed m are of major bridges.Features of suspenses.	tenance and c ajor bridges— sion bridges a	onstruction of critical studies and cable stay	7



- 1. Raina V.K (1991), "Concrete Bridge Practice– Analysis, design & economics", Tata Mc– GrawHill, publishing company, New Delhi.
- 2. Raina V.K (1988), "Concrete Bridge Practice– Construction Maintenance & Rehabilitation", Tata Mc–GrawHill, publishing company, New Delhi.
- 3. Victor D.J (19991), "Essentials of Bridge Engineering", Oxford & IBH publishing company, New Delhi.
- 4. Ponnuswami S (1993), "Bridge Engineering", Tata Mc–GrawHill, publishing company, New Delhi.
- 5. Krishna Raju N (1996), "Design of Bridges", TataMcGrawHill, publishing company, New Delhi.
- 6. BIS, IS: 456-2000, IS: 1343-1980
- 7. IRC, IRC 5, IRC 6, IRC 18, IRC 21, IRC 83 (Part 1-3)



COURSE O	CODE	COURSE NAME	L-T-P-C	YEAR	
СЕТЕЗ	4	REMOTE SENSING AND GIS IN TRANSPORTATION PLANNING	2-1-0-3	2015	
<ul> <li>COURSE OBJECTIVES:</li> <li>To explain the purpose of accurate mapping of all features under different spatial a temporal scales of all kinds of terrain and land under water bodies.</li> <li>To discuss on the advantages of remote sensing compared to traditional surveying techniques in terms of time, accuracy and output.</li> <li>To explain the purpose and methods of obtaining abstract data both spatial and temporally.</li> <li>To illustrate the application of GIS and remote sensing in solving real world transportation problems</li> </ul>					nd
<ul> <li>After completion of the course the student should be able to</li> <li>Choose the remote sensing image from different sensors, resolutions, spatial and tempor scales.</li> <li>Explain and to comprehend large tracks of earth surface with less time and cost but mo accuracy.</li> <li>Communicate to the common man his analysis of different problems developments, benefits by Preparing different thematic maps.</li> <li>Apply GIS and remote sensing techniques in solving real world transportation problem</li> </ul>					emporal t more S, blems
MODULE COURSE CONTENT (32hrs)				HRS	
I Introduction to remote sensing: Definition – Components of Remote Sensing – Energy, Sensor, Interacting Body –Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms –Balloons, Helicopters, Aircraft and Satellites – Electromagnetic Radiation – EMR Spectrum			8		
INTERNAL TEST 1(Module 1)					
ш	II Introduction to GIS: Basic Concept and Components – Hardware, Software – Data Spatial and non-spatial –Geo-referencing – Map Projection – Types of Projection – Simple Analysis – Data retrieval and querying			8	
		INTERNAL TEST 2(Modu	le 2)		
ш	Data s structur data st analysi Spatial	structures and analysis: Database – res – Data storage – Run length,Chain a torage – Topology – GIS Modeling – s– Buffering and overlaying techniques Analysis	Raster and and Block co Raster and Network A	Vector data ding – Vector Vector data nalysis –	8



IVlocation of transport terminals and roadside facilities, bus stops - Route optimization - Bus route rationalization - Accident analysis - Applications8	
of Aerial Photography and Satellite Imageries.	IV

- 1. Burrough P.A, Principles of GIS for Land Resources Assessment, Oxford Publication, 1994.
- 2. Jeffrey Star and John Ester, Geographical Information System An Introduction, Prentice Hall Inc., Englewood Cliffe, 1990.
- Marble, D.F, Calkins, H.W and Penquest, Basic Readings in GIS, Speed System Ltd., New York, 1984
- 4. Anji Reddy, Remote Sensing and Image Interpretation, John Wiley and Sons Inc. New York, 1987.
- 5. M.G.Srinivas, Remote Sensing Applications, Narosa Publishing House, 2001



COURSE CODE	COURSE NAME	L-T-P-C	YEAR
CETE36	ROAD SAFETY AND ENVIRONMENT	2-1-0-3	2015

#### **COURSE OBJECTIVES:**

- Explain the causes of accidents, statistical measures of accident data analysis
- Explain road safety audit principle and procedure, various traffic management techniques and their effectiveness
- Explain different transport related pollution
- Explain the concepts of EIA process

#### **COURSE OUTCOMES:**

After the completion of the course students should be

- Able to acquire knowledge about statistical methods for accident analysis
- Able to remember the process of road safety audit and the measures of improving road safety.
- Capable of analyzing the factors affecting the transport related pollution
- Capable of analyzing the EIA requirements of Highways projects

MODULE	COURSE CONTENT (32 hrs)	HRS			
I	<b>Introduction:</b> Multidisciplinary approach to planning for traffic safety and injury control; Causes of road accidents; Control measures; Roles of vehicle, roadway traffic, driver, and environment, crash and injury causations; Accident analysis, pre crash and post crash models; Conflict points.	8			
INTERNAL TEST 1(Module 1)					
Π	<b>Road Safety Audit and Traffic Management Techniques:</b> Principles- Procedures and Practice, Code of Good Practice and Checklists. Road safety Audit; stages of auditing; methods involved; case studies. Road safety issues and engineering, education, enforcement measures for improving road safety. Local area management. Low cost measures, area traffic control. Various types of medium and long term traffic management measures and their uses. Evaluation of the effectiveness and benefits of different traffic management measures, management and safety practices during road works.	8			
INTERNAL TEST 2(Module 2)					
III	<b>Transport related pollution</b> ; Road transport related air pollution, sources of air pollution, effects of weather conditions, Vehicular emission parameters, Urban and non urban traffic noise sources, Noise pollution, noise barriers; pollution standards, measurement and analysis of vehicular emission; Imitative measures.	8			



IV	<b>EIA:</b> Introduction: Concepts of environmental impact analysis, key features of National environmental policy act and its implementation, screening in the EIA process, utility and scope of EIA process, Environmental protection acts EIA at national level. EIA requirements of	8		
Highways projects, EIA practices in India.				

- 1. Evans S.K., Traffic Engineering Handbook, Institute of Traffic Engineers, USA
- 2. Wohl M., Martin B.V., "Traffic system analysis of Engineers & Planners", McGraw Hill, New York.
- 3. Babkov V.F., "Road Conditions & Traffic Safety", MIR Publishers, Moscow, 1975
- 4. Kadiyali L.R., "Traffic Engineering & Transport Planning", Khanna Publishers, 2003
- 5. Little A.D., "The state of art of Traffic Safety", Paraeger Publishers, New York, 1970
- 6. Canter L.W., Environmental impact assessment, McGraw-Hill, 1997
- 7. Betty Bowers Marriott, Environmental Impact Assessment: A Practical Guide, McGraw-Hill Professional, 1997.
- 8. Relevant IRC codes.



COURSE CODE	COURSE NAME	L-T-P-C	YEAR
05CE 6366	SEMINAR- I	0-0-2-2	2015

Each student shall prepare a seminar paper on any topic of interest related to the core/elective courses being undergone in the first semester of the M. Tech programme. He/she shall select paper from reputed journals. They should get the paper approved by the Programme Coordinator/Faculty Members in the concerned area of specialization and shall present it in the class in the presence of Faculty in-charge of seminar class. Every student shall participate in the seminar. Grade will be awarded on the basis of the student"s paper, presentation and his/her participation in the seminar.

**Goals**: This course is designed to improve written and oral presentation skills and to develop confidence in making public presentations, to provide feedback on the quality and appropriateness of the work experience, and to promote discussions on design problems or new developments.

COURSE CODECOURSE NAMEL-T-P-CYEAR					
05CE 6388 0.2.4.2 2015					
MINI PROJECT 0-2-4-2 2015					
Mini Project shall be done in an industry/institute approved by the department and under the					
guidance of a staff member in the concerned field. At the end of the work he/she has to submit a					
report which is to be	report which is to be evaluated by the internal academic auditing cell.				



COURSE CODE	COURSE NAME	L-T-P-C	YEAR
05CE 6392	TRANSPORTATION ENGINEERING LAB-II	0-0-2-1	2015

#### . Objectives.

- To make the students aware of various traffic surveys.
- To familiarize different software packages in transportation engineering.

#### Outcomes.

After completion of the course the student should be able to

- To conduct and interpret different traffic data.
- To apply software packages in transportation planning.

Traffic Surveys, Volume count, Speed study, Parking study, Intersection turning movements, Speed and Delay study, Moving observer survey.

Traffic noise measurement, Vehicle emission testing, Road lighting, Driver reaction time, Road side and house hold interviews.

Study of traffic engineering software for microscopic and macroscopic flow



COURSE (	CODE	COURSE NAME	L-T-P-C	YEAR	
05CE 7.	341	GROUND IMPROVEMENT TECHNIQUES	2-1-0-3	2015	
COURSE (	)BJECT	TIVES:			
• Expl	ain vari	ous ground improvement techniques an	d the types	of compaction	and its
effec	t on soil	properties			
Explain the types of drains and various stabilization techniques					
• Info	orm abou	at the types of reinforcement and design p	orinciples, gro	outing technique	es
Introduction of various type of geotextiles and functions					
COURSE OUTCOMES:					
After the con	mpletion	of the course students should be			
Capab	ole of ren	nembering various ground improvement	techniques		
• Capab	ole of sel	ecting different stabilization process of so	oil using lime	, fly ash etc	
• Able t	o remen	ber principles and methods of grouting	techniques		
Understandvarioustypesofgeosynthetics and its applications					
MODULE	COURSE CONTENT (32 hrs)			HRS	
	Introdu	iction to Ground improvement tech	niques: Rolo	e of ground	
	1mprov	ement in foundation engineeringDra	ainage and	Dewatering:	
т	Nietnoo	is of dewatering and pressure relief-de	ep well drai	nage vacuum	
1	dewate	ring systems - drainage by electroosmos	sis – analysis	and design of	8
	uewate	sint systems – instantion and operation	vecuum dou	ustoring	
	electro	osmosis	, vacuum uev	vatering,	
	ciccuto				
		INTERNAL TEST I(MOdu	le 1)		
	In-situ	densification methods in granular soil	s: Introduction	on-mechanical	
	stabiliz	ation-deep dynamic compaction-vibro co	mpaction-bl	asting.	
	In-situ	densification methods in cohesive soil	ls: Preloading	g- Concept of	
II	three d	imensional consolidation –sand drain de	esign and me	thods of their	8
	installa	tion – fabric drains-stone columns d	& lime piles	s (installation	
	technig	ues only)Cement and lime stabilization:	cement stab	ilization-types	
of soil cement-factors affecting soil cement mixing, Lime stabilization-					
	errect	DI IIIIe on soil properties.	<b>1</b> 2 <b>2</b> )		
	Introdu	INTERINAL TEST 2(Modul	ie 2)	tion anostina	
тт	compa	action grouting hydro fracturing. Grout a	ions –permea	Classification	Q
	of grou	ts	onny Katio -	Classification	0
	01 5100				



Approved by Govt. of Rajasthan vide Sunrise University Act, 2011 Recognized by UGC Act, 1956 u/s 2 (f)

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	Suspension grouts -cement grouts -admixtures used & their role -					
	bentonites grouts -cement and bentonite grouts - lime grouts - asphaltic					
	emulsion grouts – Solution grouts – aqueous solution - non-aqueous					
	solutions – colloidal solutions – advantages and disadvantages of solution					
grouts over suspension grouts. Properties of grouts: viscosity, fluidity,						
	stability, rigidity, thixotropy, Applications of grouting					
	Earth Reinforcement- Concept of reinforced earth -load transfer					
	mechanism and strength development - Stability analysis of reinforced					
TX/	earth retaining walls-external stability analysis, internal stability analysis	8				
1 V	(brief mention about the methods only) - application areas.	0				
	Geosynthetics: Classification- Functions of geotextiles as separators,					
	reinforcement, filters and in drainage-damage and durability of geotextiles.					
END SEMESTED EVAM (ALL Modulos)						

- 1. Robert M. Koerner Construction and Geotechnical Methods in Foundation Engineering, Mc Graw Hill
- 2. C.J.F.P Jones Earth Reinforcement and soil structures, Buuterworths
- 3. Purushothama Raj.P Ground Improvement techniques ,Laxmi Publications(P) Ltd., New Delhi
- 4. Shashi.K.Gulhati & Manoj Datta –Geotechnical Engineering , Tata McGraw Hill
- 5. Shroff AV and Shah. D.L –Grouting technology in tunneling and Dam construction, Oxford and IBH
- 6. Robert M. Koerner "Designing with Geosynthetics", Prentice Hall Mc Graw Hill
- 7. G. L. Sivakumar, G. L. Babu, Soil Reinforcement and geosythetics, University Press



COURSE C	CODE	COURSE NAME	L-T-P-C	YEAR				
05CE 7.	343	PAVEMENT MATERIALS	2-1-0-3	2015				
COURSE O	)BJECT	TIVES:						
• To e	xplain th	ne properties of aggregates and different t	ests					
• To e	• To explain the origin, properties, constituents of bitumen and tar							
• To e	xplain al	bout cut back bitumen and bitumen emul	sions, test pro	cedures and the	uses			
• Mak	e the stu	dents aware of the mechanism of strippir	ng, adhesion fa	ailures.				
• To il	lustrate	the bituminous mix design method.	-					
• To g	et an ide	a of modified binders.						
COURSE O	OUTCO	MES:						
After the con	mpletion	n of the course students should be						
• Able	to acqui	ire and apply knowledge of properties of	road aggregat	es.				
• Able	to acqui	ire and apply knowledge of properties of	binders.					
Capa	able of a	nalyzing adhesion failure and mechanism	n of stripping.					
Able	to desig	gn bituminous mixes.						
MODULE		COURSE CONTENT (3	2 hrs)		HRS			
	Subgra	ade soil: Soil composition and structur	e, classificatio	on relevant to				
т	paveme	ent design.						
1	Aggregates: Origin, classification, requirements, properties and tests,							
	concep	ts of size and gradation.						
		INTERNAL TEST 1(Modu	le 1)					
	Bitum	en and Tar: Origin, chemical constitution	on, requireme	nts, properties				
TT	and tes	ts.			0			
11	Bitumi	nous Emulsions and Cutbacks:Preparation	on, characteris	tics, tests and	0			
	uses.							
		INTERNAL TEST 2(Modu	le 2)					
	Modifi	ied binders: HMA, WMA, CMA.						
III	Adhesi	ion of Bituminous Binders to Road Ag	gregates: Adl	nesion failure,	8			
	mechai	nism of stripping, tests and methods of in	nproving adhe	sion.				
	Bitumi	inous Mixes: Mechanical properties, de	ense and oper	textured				
IV	mixes,	bituminous mix design by Marshal Meth	iod.	<b>.</b>	8			
_ ,	Ceme	nt concrete for pavement construction	: requirement	s, mix design	-			
	for cen	nent concrete pavements, filler and sealer	materials.					



- 1. Khanna, S.K., Justo, C.E.G., and Veeraragavan, A., 'Highway Engineering', Nem Chand and Bros, Roorkee, 2014.
- 2. Partha Chakroborty and Animesh Das, "Principles of Transportation Engineering", Prentice Hall (India), New Delhi, 2011.
- 3. Relevant IRC and MORTH Publications.
- 4. RRL, D S I R, `Bituminous Materials in Road Construction", HMSO Publication
- 5. RRL, D S I R, `Soil Mechanics for Road Engineers", H M S O Publication



COURSE	CODE	COURSE NAME	L-T-P-C	YEAR	
05CE 7.	345	TRANSPORTATION FACILITY DESIGN	2-1-0-3 2015		
COURSE C	)BJECT	TIVES:			
• To g	et an ide	a of different types of intersections.			
• To e	xplain th	e functional planning and design of term	inal buildings		
• To m	hake the	students aware of geometric design of the	e highway cro	oss section elem	ents.
• To il	lustrate	the design of different types of intersection	ons.		
COURSE (	OUTCO	MES:			
After the con	mpletion	of the course students should be			
• Able	to get a	n idea of different types of intersections.			
• Able	to expla	in the functional planning and design of	terminal build	lings.	
• Able	to make	the students aware of geometric design	of the highwa	y cross section	
elements.					
<ul> <li>Capa</li> </ul>	able of d	esigning various intersections.			
MODULE		COURSE CONTENT (3	2 hrs)		HRS
	Introd	uction: Design of highways, design of at	-grade interse	ections, design	
Ι	of sign	alized intersection, design of grade sepa	rated intersec	ction, terminal	0
	design,	and design of facilities for non-motorize	d transport.		8
		INTERNAL TEST 1(Modu	le 1)		
	Termi	nal Planning & Design Terminal Plar	nning & Des	ign: Terminal	
	functio	ns, analysis of terminals, process flow c	harts of passe	enger & goods	
II	termina	als, terminal processing time, waiting	time, capacit	y & level of	8
	service	concept, study of typical facilities of hi	ighway, trans	it, airport and	
	waterw	ay terminals, concept of inland port.			
	-	INTERNAL TEST 2(Modu	le 2)		<b></b>
	Design	of Highways: Hierarchy of highway	system, fun	ctions, design	
	designa	ations, concepts in horizontal & vertic	cal alignmen	t, integration,	0
	optical	design, geometrical standards for	mobility &	accessibility	8
of existing geometries					
	Design	of Intersections: Deview of design of a	t grada intera	actions signal	
	coordin	of intersections. Review of design of a lation $-$ graphic methods & computer t	echniques or	ade separated	
IV	intersed	ration – graphic methods & computer t	nt types & c	seometric	8
	standar	ds spacing & space controls ramps & ou	ore area desig	n	
	Standal	as, spacing a space controls, rumps a g			



- 1. Kadiyali, L.R., "Traffic Engineering and Transport Planning", Khanna Publishers.
- 2. IRC-SP41: Guidelines for the Design of At-Grade Intersections in Rural & Urban Areas
- 3. Salter, R J., Highway Traffic Analysis and Design, ELBS.
- 4. Edward K. Morlock, "Introduction to Transportation.



COURSE (	CODE	COURSE NAME	L-T-P-C	YEAR	2
05CE 7.	351	PAVEMENT EVALUATION & MANAGEMENT	2-1-0-3	2015	
<ul> <li>COURSE OBJECTIVES:</li> <li>Recall the importance of evaluation and strengthening of pavements</li> <li>Introduce the various methods of structural and functional evaluation of rigid and flexible pavements</li> <li>Introduce the various methods of overlay design</li> <li>Discuss the need for pavement management and explain the techniques involved</li> <li>COURSE OUTCOMES:</li> <li>After completion of the course the student will be able to</li> <li>Identify the factors causing deterioration of pavements and propose remedial measures</li> <li>Carry out structural and functional evaluation of flexible and rigid pavements</li> </ul>					
• I	Develop	a framework for efficient pavement mana	agement syste	m	
MODULE	MODULECOURSE CONTENT (32 hrs)HRS				HRS
I	Structural and functional requirements of flexible and rigid pavements: pavement distress; different types of failures, causes and remedial measures Pavement Surface Condition & Its Evaluation: Methods of Measurement of Skid Resistance, Unevenness, Ruts and Cracks. Pavement Surface Condition Evaluation by Physical Measurements, by Riding			8	
	<u> </u>	INTERNAL TEST 1(Modu	le 1)		
Pavement Structure & Its Evaluation: Factors affecting Structural Condition of Flexible and Rigid Pavements; Effects of Subgrade Soil, Moisture, Pavement Layers, Temperature, Environment and Traffic on Structural Stability, Pavement Deterioration; Evaluation by Non- 8IIStructural Stability, Pavement Deterioration; Evaluation by Non- Destructive Tests such as FWD, Benkelman Beam Rebound Deflection, Plate Load Test, Wave Propagation and other methods of Load Tests; Evaluation by Destructive Test Methods, and Specimen Testing				8	
	INTERNAL TEST 2(Module 2)				
ш	Paveme Overlay Method Use of	ent Overlays & Design: Pavement Ov y over Flexible Pavement by Benkelman ds, Flexible Overlays and Rigid Overla Geosynthetics in Pavement Overlays.	erlays, Desig Beam Deflec tys over Rigi	n of Flexible tion and other d Pavements,	8



	Pavement Management System: Concepts of pavement management	
	systems, pavement performance prediction – concepts, modeling	
187	techniques, structural conditional deterioration models, mechanistic &	0
1 V	empirical models, functional condition deterioration models, unevenness	0
	deterioration models and other models, ranking and optimization	
	methodologies.	

- 1. Yoder E.J. and Witezak, Principles of Pavement Design, II Ed., John Wiley and Sons, 1975.
- 2. Woods, K.B., Highway Engineering Hand Book, McGraw Hill Book Co.
- 3. David Croney, The Design and Performance of Road Pavements, HMSO Publications, 2008.
- 4. Haas and Hudson, Pavement Management System, McGraw Hill Book Co., New York, 1982.
- 5. Per Ullidtz, Pavement Analysis, Elsevier, Amsterdam, 1998.
- 6. HRB/TRB/IRC/International Conference on Structural Design of Asphalt Pavements, 1988.
- 7. SHAHIN, M Y, Pavement management for airport, roads and parking lots, Chapman and hall 2005.
- 8. Yang H. Huang, Pavement Analysis and Design, Prentice Hall, 2003.



COURSE O	CODE	COURSE NAME	L-T-P-C	YEAR	2
05CE 7.	05CE 7353 PUBLIC TRANSPORT 2-1-0-3 2015 PLANNING AND DESIGN		2015		
COURSE (	)BJECT	TIVES:			
• To m	hake the	students aware of the importance of publ	ic transport s	ystem.	
• To e	xplain th	e transit network planning.			
• To e	xplain tr	ansit scheduling procedures			
To design public transport facilities					
COURSE C After the co	DUTCO mpletion	MES: of the course the students should be able			
• To	explain t	the importance of public transport system	l <b>.</b>		
• To plan transit network.					
• To e	xplain tr	ansit scheduling and organizational struc	ture.		
• To plan and design bus terminals and other amenities.					
MODULE	NODULE         COURSE CONTENT (32 hrs)           Deblie Terrenet Definitions and the fact bits (and the second s			HRS	
<b>Public Transport</b> . Definitions, modes of public transport and comparison,					
I	I public transport travel characteristics, trip chaining, technology of bus, rail,				8
	Tapiù u	ansit systems, basic operating elements.			
		INTERNAL TEST 1(Modu	le 1)		
II	II Transit Network Planning: Planning Objectives, principles, considerations, transit lines – types, geometry and characteristics, transit routes and their characteristics, timed transfer networks, prediction of transit usage, evaluation of network, accessibility considerations.			8	
		INTERNAL TEST 2(Modu	le 2)		
ш	Transi service schedu Transit manage econom	t Scheduling: Components of schedulin requirements, scheduling procedure, ling. Agency and Economics: Organizational ement and personnel, transit system s nic measures, operations, fare structure.	g process, de marginal ri structure of t tatistics, per	termination of dership, crew ransit agency, formance and	8
IV	<b>Design</b> of good facilitie	of Facilities: Design of bus stops, design d layout, types of layout, depot location es and amenities.	gn of termina , twin depot	ls – principles concept, crew	8



- 1. Vukan R. Vuchic, Urban Transit : Operations, Planning and Economics, Wiley, 2005.
- 2. Peter White, Public Transport, UCL Press, 2008.
- 3. Kadiyali L.R., Traffic Engineering and Transport Planning, Khanna Publishers, 1987.
- 4. Khisty, C J., Transportation Engineering An Introduction, Prentice-Hall, NJ, 2002.
- 5. TCRP Report 30, TCRP Report 95, TCRP Report 100
- 6. Ceder A, Public Transit Planning and Operation, Elsevier, 2007.



COURSE C	CODE	COURSE NAME	L-T-P-C	YEAR	2
05CE 73	355	ADVANCED HIGHWAY MATERIALS	2-1-0-3	2015	
<ul> <li>COURSE OBJECTIVES:</li> <li>To explain the nature and properties of aggregates.</li> <li>To illustrate the properties, uses and principles of bituminous construction.</li> <li>To make the students aware of cement/concrete based materials in pavement construction.</li> <li>To get an idea of advanced materials in highway construction.</li> <li>COURSE OUTCOMES:</li> <li>After the completion of the course students should be</li> <li>Able to acquire and apply knowledge of properties of road aggregates.</li> <li>Able to acquire and apply knowledge of properties of binders.</li> <li>Capable of designing concrete mix.</li> </ul>					
• Able	Able to design pavement using advanced materials.      MODULE     COURSE CONTENT (32 hrs)			HRS	
Ι	I aggregate for Portland Cement Concrete – light weight aggregate – tests on aggregate – specification.			8	
		INTERNAL TEST 1(Modu	le 1)		
п	Bituminous Materials: conventional and modified binders – production – types and grade – physical and chemical properties and uses – types of asphalt pavement construction – principles of bituminous pavement construction – tests on bituminous materials. Bituminous Mix design – modified mixtures – temperature susceptibility and performance			- production – ses – types of ous pavement Mix design – nce.	8
		INTERNAL TEST 2(Modu	le 2)		
ш	III Cement /concrete based materials: Cement – properties – PCC mix design and properties – modified PCC – Mix Design – Behavior – Performance – Tests on Cement and Concrete mixes. High Performance Concrete – low shrinkage – increased strength			8	
Index on content and conte		oolymerization – Reinforced Polymers – d Materials – vaste products art materials –	8		



#### **REFERENCES:**

- 1. P. T. Sherwood, *Alternative Materials in Road Construction*, Thomas Telford Publication, London, 1997.
- 2. RRL, DSIR, Soil Mechanics for Road Engineers, HMSO, London, 1995
- 3. Koerner, R. M. *Designing with Geosynthetics*, Prentice Hall, Englewood Cliffs, New Jersey, U.S.A.

Shan Somayaji, Civil Engineering Materials, second edition, Prentice Hall Inc., 2001.



COURSE CODE	COURSE NAME	L-T-P-C	YEAR
05CE7367	SEMINAR - II	0-0-2-2	2015
Each student is required to present a technical paper on a subject approved by the			
department. The paper should be on a recent advancement/trend in the field of Transportation			
engineering. He/she shall submit a report of the paper presented to the department.			

COURSE CODE	COURSE NAME	L-T-P-C	YEAR
05CE 7387	PROJECT (PHASE-I)	0-0-8-6	2015

The thesis (Phase-I) shall consist of research work done by the candidate or a comprehensive and critical review of any recent development in the subject or a detailed report of project work consisting of experimentation/numerical work, design and or development work that the candidate has executed.

In Phase-I of the thesis, it is expected that the student should decide a topic of thesis, which is useful in the field or practical life. The students should refer national and international journals, proceedings of national and international seminars and conferences. Emphasis should be given to the introduction to the topic, literature review, and scope of the proposed work along with some preliminary work / experimentation carried out on the thesis topic.

Student should submit Phase-I thesis report in two copies covering the content discussed above and highlighting the features of work to be carried out in phaseII of the thesis. Student should follow standard practice of thesis writing.

The candidate should present the work and the assessment will be made by a panel of internal examiners one of which will be the internal guide. These examiners should give suggestions in writing to the student to be incorporated in thesis work Phase-II.



COURSE CODE	COURSE NAME	L-T-P-C	YEAR
05CE 7388	PROJECT (PHASE II)	0-0-21-12	2015
In the fourt	h semester the student has to continue th	e thesis work	and present the report.
At the end of the se	mester he/she has to submit a detailed r	report and has	s to present for a viva-
voce. The work c	arried out should lead to a publica	ation in a l	National/ International
conference/journal.	They should submit the paper before the	evaluation of	the thesis and specific
weightage will be gi	ven to the accepted papers in reputed cor	nferences/jour	nals.