Ref No:

Sri Krishna Institute of Technology, Bangalore

COURSE PLAN

Academic Year 2019-2020

Program:	B E – CIVIL ENGINEERING
Semester :	6
Course Code:	17CV63
Course Title:	HIGHWAY ENGINEERING
Credit / L-T-P:	4/4-0-0
Total Contact Hours:	50
Course Plan Author:	RAMYA B

Academic Evaluation and Monitoring Cell

Sri Krishna Institute of Technology

#29,Chimney hills,Hesaraghata Main road, Chikkabanavara Post
Bangalore – 560090, Karnataka, INDIA
Phone / Fax :08023721477/28392221/23721315
Web: www.skit.org.in , e-mail: skitprinci@gmail.com

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A. COURSE INFORMATION

1. Course Overview

Degree:	B.E	Program:	CIVIL ENGINEERING
Semester:	6	Academic Year:	2018-19
Course Title:	Highway Engineering	Course Code:	15cv63
Credit / L-T-P:	4/4-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	50	SEE Marks:	80 Marks
CIA Marks:	20	Assignment	1 / Module
Course Plan Author:	RAMYA B	Sign ..	Dt:
Checked By:		Sign ..	Dt:
CO Targets	CIA Target : 70%	SEE Target:	67%

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute.

Module	Content	Teaching Hours	Blooms Learning Levels
1	**Principles of Transportation Engineering:** Importance of transportation,Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute **Highway Development and Planning:** Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4thtwenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan-vision 2021.	10	L2
2	**Highway Alignment and Surveys:** Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects **Highway Geometric Design:** Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves	10	L4
3	**Pavement Materials:** Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction with Problems Aggregates- Desirable properties and tests, Bituminous materials- Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material **Pavement Design:** Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples	10	L4
4	**Pavement Construction:** Design of soil aggregate mixes by Rothfuch's method. Uses and properties of bituminous mixes and cement concrete in pavement construction. Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base, iii) WMM base, iv) Bituminous Macadam, v) Dense	10	L3

	Bituminous Macadam vi) Bituminous Concrete, vii) Dry Lean Concrete sub base and PQC viii) concrete roads		
5	**Highway Drainage:** Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location **Highway Economics:** Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods-Examples, Highway financing-BOT-BOOT concepts	10	L4
-	**Total**	**50**	

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	-	-
1, 2, 3, 4, 5	S K Khanna and C E G Justo, " Highway Engineering", Nem Chand Bros, Roorkee	1,3, 4	In Lib
1,5	L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.	4, 6	In Lib
2, 3	R Srinivasa Kumar, "Highway Engineering", University Press.	6,7	Not available
2, 3,4	K.P.subramanium, "Transportation Engineering", SciTech Publications, Chennai	6,8	Not available
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	-	-
3,4	Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi.	3,4	Not available
1, 2,3	C. JotinKhisty, B. Kent lal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.		Not available
C	**Concept Videos or Simulation for Understanding**	-	-
C1	https://nptel.ac.in/courses/105101087/		
C2	https://www.youtube.com/watch?v=5zKC_aq4ypM&list=PLE88643285BC70E0F		
C3	https://www.youtube.com/watch?v=tIkBEky7WsY		
C4	https://www.youtube.com/redirect?q=http%3A%2F%2Fnptel.iitm.ac.in&event=video_description&v=YAEyLOCU-8I&redir_token=Zm82kES57QKb5c2O6fGA1wxhBe58MTU1NTIzNDAxOEAxNTU1MTQ3NjE4		
C5	https://www.youtube.com/redirect?q=http%3A%2F%2Fnptel.iitm.ac.in&v=wSp3BPaSMR0&redir_token=PaBLx_T_sngphXZj-1o06vh3au58MTU1NTIzNDA0OEAxNTU1MTQ3NjE4&event=video_description		
D	**Software Tools for Design**	-	-
E	**Recent Developments for Research**	-	-
F	**Others (Web, Video, Simulation, Notes etc.)**	-	-
1			

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Instr Method	Assessment Method	Blooms' Level
1	15cv63.1	The student should be able to understand the Principles of Transportation Engineering	05	Lecture	Internal test Assignment	L2
1	15cv63.2	The student should be able to understand Highway planning and development considering engineering and financial aspects, regulations and policies, socio economic impact	05	Lecture	Internal test Assignment	L2
2	15cv63.3	The students should be able to Acquire the capability of proposing a new alignment and re-alignment of existing roads	05	Lecture	Internal test Assignment	L3
2	15cv63.4	The student should be able to design the geometric elements of a highway network	05	Lecture	Internal test Assignment	L4
3	15cv63.5	The student should be able to Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction	05	Lecture	Internal test Assignment	L3
3	15cv63.6	The student should be able to understand pavement its components and requirements	05	Lecture	Internal test Assignment	L4
4	15cv63.7	The student should be able to understand the various pavement	10	Lecture	Internal test	L3

		construction activities			Assignment	
5	15cv63.8	The student should be able to understand the drainage system for a highway	05	Lecture	Internal test Assignment	L3
5	15cv63.9	The student should be able to Evaluate the highway economics by select methods and understand the basic knowledge of various highway financing concepts.	05	Lecture	Internal test Assignment	L4
-	-	**Total**	**50**	-	-	**L2-L4**

2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	Highway planning and development	CO1	L2
2	Highway Geometric Design	CO2	L4
3	Laboratory investigation for Pavement Materials	CO3	L2
4	Pavement Design and construction	CO4	L3
5	Designing Highway and Drainage System	CO5	L3
6	Evaluating the highway economics	CO6	L4

3. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes															-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1																		
2																		
3																		
4																		
5																		
-	**15EE662.**	Average																-
-	PO, PSO	1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design																

4. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1		Seminar	2nd week / date	Dr XYZ, Inst	List from B4 above
2		Seminar	3rd Week		

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Principles of Transportation Engineering, Highway Development and Planning:	10	2	-	-	1	1	2	CO1	L2
2	Highway Alignment and Surveys, Highway Geometric Design	10	2	-	-	1	1	2	CO2	L3
3	Pavement Materials, Pavement Design	10	-	2	-	1	1	2	CO3	L4
4	Pavement Construction	10	-	2	-	1	1	2	CO4	L3
5	Highway Drainage, Highway Economics	10	-	-	4	1	1	2	CO5	L4
-	**Total**	**50**	**4**	**4**	**4**	**5**	**5**	**10**	**-**	**-**

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam – 1	15	CO1, CO2,	L2,L3
3, 4	CIA Exam – 2	15	CO3,CO4	L2, L4
5	CIA Exam – 3	15	CO4 ,CO5,CO6	L4
1, 2	Assignment - 1	05	CO1, CO2,	L2, L3,
3, 4	Assignment - 2	05	CO3,CO4	L2, L3
5	Assignment - 3	05	CO4 ,CO5,CO6	L3, L4
1, 2	Seminar - 1		-	-
3, 4	Seminar - 2		-	-
5	Seminar - 3		-	-
1, 2	Quiz - 1		-	-
3, 4	Quiz - 2		-	-
5	Quiz - 3		-	-
1 - 5	Other Activities – Mini Project	-		
	Final CIA Marks	**20**	**-**	**-**

D1. TEACHING PLAN - 1

Module - 1

Title:			Appr Time:	10 Hrs
a	**Course Outcomes**		**CO**	**Blooms**
	The student should be able to:			
1	Analyze the planning process required by Identifying different highway system for different category of traffic		CO1	L2
b	**Course Schedule**		-	-

Class No	Portion covered per hour	-	-
1	Importance of transportation, Different modes of transportation and comparison	CO1	L2
2	Characteristics of road transport Jayakar committee recommendations,	CO1	L2
3	implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute	CO1	L2
4	Road types and classification, road patterns, planning surveys	CO1	L2
5	saturation system of road planning phasing road development in India	CO1	L2
6	problems on best alignment among alternate proposals Salient Features of 3rd and 4thtwenty year road development plans and Policies	CO1	L2
7	Present scenario of road development in India (NHDP & PMGSY)	CO1	L2
8	Road development plan - vision 2021	CO1	L2
c	**Application Areas**		
-	Students should be able employ / apply the Module learnings to . . .		
1	Highway Planning	CO1	L2
2			
d	**Review Questions**		
-			
1	Explain Scope of Highway planning	CO1	L2
2	Road types and classification	CO1	L2
3	Calculation of road Road length	CO1	L3
e	**Experiences**	-	-
1		CO1	L2
2			

Module – 2

Title:		Appr Time:	10 Hrs
a	*Course Outcomes*	CO	Blooms
-	The student should be able to:	-	Level
1	The students should be able to Acquire the capability of proposing a new alignment and re-alignment of existing roads	CO1	L3
b	*Course Schedule*	-	-
Class No	Portion covered per hour	-	-
1	Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study	CO2	L3
2	Reconnaissance, Preliminary and Final location & detailed survey,	CO2	L3
3	Reports and drawings for new and re-aligned projects	CO2	L3
4	Cross sectional elements–width, surface, camber, Sight distances	CO2	L3
5	SSD, OSD, ISD, HSD	CO2	L3
6	Design of horizontal and vertical alignment–curves,	CO4	L3
7	super-elevation, widening	CO3	L3
8	gradients, summit and valley curves	CO3	
9	Problems on SSD, OSD, ISD, HSD	CO4	
10	Problems on SSD, OSD, ISD, HSD	CO4	
c	**Application Areas**	-	-

-		Students should be able employ / apply the Module learnings to . . .	-	-
1		Traffic volume count	CO2	L3
2		Zoning	CO2	L4
d		**Review Questions**	-	-
-				
1		Explain with near sketches the various factors controlling the alignment	CO2	L2
2		What are the objectives of preliminary survey for highway alingment	CO2	L3
3		Derive an expression for finding the extra widening required on horizontal curve	CO3	L3
4		The speeds of overtaking and over taken vesicles are 70kmph and 40kmph respectively on a two way traffic road. The average acceleration during overtaking may be assumed as 0.99m/sec² calculate safe overtaking sight distance and show the details of overtaking zone with sketches	CO3	L4
5		Briefly explain how MAP study is helpful in the alignment of new highway	CO2	L2
6				
e		**Experiences**	-	-
1			CO2	L2
2				

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:	17CV63	Sem:		VI	Marks:		30	Time:		75MINUTES		
Course:	Highway engineering											
-	-	**Note: Answer any 1 FULL question from each part, all questions carry equal marks.**							**Marks**	**CO**	**Level**	
1	a	Explain how the wheel load and its repetition of loads effects the CC							07	CO1	L2	
	b	Write the requirements of the joints in CC pavements							08	CO3	L2	
		OR										
2	a	Write in brief about the Design procedure of C.C. Pavement as per IRC: 38 –2002							07	CO4	L2	
	b	Explain with a neat sketch the mechanism of mud pumping in CC pavement constructed on clayey strata. Indicate the remedial measures							08	CO2	L2	
3	a	Explain the average growth factor method with equation							07	CO1	L2	
	b	Define furness method of Trip Distribution with equation							08	CO2	L2	
		OR										
4	a	Explain with near sketches the various factors controlling the alignment							07	CO1	L2	
	b	What are the objectives of preliminary survey for highway alingment							08	CO2	L2	
		Derive an expression for finding the extra widening required on horizontal curve							7	CO3	L3	

b. Assignment -1

<td colspan="8" align="center">Model Assignment Questions</td>
Crs Code:	17cv63	Sem:	VI	Marks:	5 / 10	Time:	90 – 120 minutes
Course:	<td colspan="7">Highway engineering</td>

Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.

SNo	Assignment Description	Marks	CO	Level
1	What is a alignment? And explain the requirements of an Ideal alignment	06	CO2	
2	Explain the factors which governs the Highway alignment	09	CO2	
3	Explain the role of transportation in developing the economy of the country	07	CO1	
4	The area of a district is 8400 km² . There are 9 towns with population greater than 5000. Calculate the length of NH, SH, MDR, ODR & VR as par 3rd 20 year road plan.	09	CO2	
5	Classify the roads in India based on location and function and explain any two	06	CO2	
6	The area of a district is 8400 km² . There are 9 towns with population greater than 5000. Calculate the length of NH, SH, MDR, ODR & VR as par 3rd 20 year road plan.	06	CO2	
7	Compare the characteristic features of different modes of transportation.	07	CO1	

D2. TEACHING PLAN - 2

Module – 3

Title:		Appr Time:	10 Hrs
a	*Course Outcomes*	CO	Blooms
-	At the end of the topic the student should be able to . . .	-	Level
1	The student should be able to understand pavement its components and requirements	CO3	L3
b	*Course Schedule*		
Class No	Portion covered per hour	-	-
1	Subgrade soil - desirable properties	CO3	L3
2	HRB soil classification-determination of CBR	CO3	L3
3	modulus of subgrade reaction with Problems	CO3	L3
4	modulus of subgrade reaction with Problems	CO3	L3
5	Aggregates- Desirable properties and tests, Bituminous materials	CO3	L3
6	Explanation on Tar, bitumen, cutback and emulsion	CO3	L3
7	tests on bituminous material	CO3	L3
8	Pavement types, component parts of flexible and rigid pavements and their functions	CO4	L3
9	component parts of flexible and rigid pavements and their functions conti-	CO4	L3
10	ESWL and its determination (Graphical method only)-Examples	CO4	L4
c	Application Areas	-	-
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Highway materials and planning	CO3	L4

d	Review Questions	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Distinguish between i(tar and bitumen ii(cut back and emulsion	CO3	L2
2	What are the desirable properties of sub grade? Enumerate the identification and classification tests of soil	CO3	L2
3	What are the desirable properties of aggregates? What test are conducted for judging the desirable properties? mention the significant of each test	CO3	L2
4	Briefly explain the role of pavement surface characteristics in highway geometric design	CO3	L3
5	List and explain various factors to be consider for pavements	CO3	L3
6.	A Load penetration values of CBR tests conducted on a specimen of a soil sample are given below. Determine the CBR value of soil if 100 divisions of load represents 190kg and in the calibration chart of proving ring load dial readings , 0,8, 15,23,29,34,37,43,48,57,63,67	CO4	l4
e	Experiences	-	-
1		CO3	L2
2			

Module – 4

Title:	Data Transmission and Telemetry Measurement of Non – Electrical Quantities	Appr Time:	10 Hrs
a	*Course Outcomes*	CO	Blooms
-	At the end of the topic the student should be able to . . .	-	Level
1	Distribute the trips by considering the travel demand modeling, desire line diagram for generated trips	CO4	L3
b	*Course Schedule*		
Class No	Portion covered per hour	-	-
1	Design of soil aggregate mixes by Rothfuch's method.	CO3	L3
2	Uses and properties of bituminous mixes and cement concrete in pavement construction.	CO3	L3
3	Uses and properties of bituminous mixes and cement concrete in pavement construction.	CO3	L3
4	Earthwork; cutting and Filling	CO4	L3
5	Preparation of subgrade,	CO4	L3
6	Preparation of subgrade,	CO4	L3
7	Specification and construction of i) Granular Sub base, ii) WBM Base,	CO4	L3
8	ii) WMM base, iv) Bituminous Macadam	CO4	L3
9	v) Dense Bituminous Macadam vi) Bituminous Concrete,	CO4	L3
10	vii) Dry Lean Concrete sub base and PQC viii) concrete roads	CO4	L3
c	Application Areas	-	-
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Road construction	CO4	L3
2	Sub base and sub grade soil	CO3	L3
d	Review Questions	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	List the desirable properties of road aggregate and Explain any two	CO3	L3

			CO	L
2	The radius of a horizontal circular curve is 10 0 meters. The design speed is 50 kmph and the design co efficient of lateral friction is 0.15 1) Calculate the superelevation required if full lateral friction is assumed to develop Calculate the co efficient of lateral friction needed if no superelevation is provided		CO4	L4
3	Describe how the quality of toughness and hardness of aggregates is evaluated in the lab		CO3	L3
4	List the various tests conducted on bitumen and explain any two		CO3	L3
5	Explain the desirable properties of subgrade soil		CO3	L3
6	Write a note on CBR		CO3	L3
7	A plate load test was conducted on a soaked subgrade during monsoon season using a plate diameter of 30 cm. The load values corresponding to the mean settlement dial readings are given below. Determine the modulus of subgrade reaction for the standard plate.		CO4	L4
8	Enumerate the steps for the determination of modulus of subgrade reaction and for making corrections for plate size		CO4	L3
e	**Experiences**		-	-
1			CO4	L3
2				

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:	17CV63	Sem:	VI	Marks:	80	Time	75 Minutes		
Course:	Highway engineering								
-	-	Note: Answer all questions, each carry equal marks. Module : 3, 4					Marks	CO	Level
	1	Describe how the quality of toughness and hardness of aggregates is evaluated in the lab					05	CO3	L3
	2	List the various tests conducted on bitumen and explain any two					06	CO4	L3
	3	Explain the desirable properties of subgrade soil					05	CO3	L3
	4	Write a note on CBR					06	CO3	L3
	5	A plate load test was conducted on a soaked subgrade during monsoon season using a plate diameter of 30 cm. The load values corresponding to the mean settlement dial readings are given below. Determine the modulus of subgrade reaction for the standard plate.					06	CO3	L4
	6	Enumerate the steps for the determination of modulus of subgrade reaction and for making corrections for plate size					06	CO3	L3
	7	Briefly explain the different types of pavement construction					05	CO4	L3

	8	Write a short note on
		    a. bituminous macadam
		    b. bituminous concrete
		    c. prime coat
							06	CO5	L3

	9.	explain the significance of ESWL in pavement design					05	CO5	L3

b. Assignment – 2

Crs Code:	17CV63	Sem:		VI	Marks:	5/10	Time:	75minutes
Course:	High way engineering							

SNo	Assignment Description	Marks	CO	Level
1	Explain the desirable properties of subgrade soil	05	CO3	L3
2	Write a note on CBR	05	CO3	L3
3	A plate load test was conducted on a soaked subgrade during monsoon season using a plate diameter of 30 cm. The load values corresponding to the mean settlement dial readings are given below. Determine the modulus of subgrade reaction for the standard plate.	07	CO4	L4
4	Enumerate the steps for the determination of modulus of subgrade reaction and for making corrections for plate size	06	CO3	L3
5	List the desirable properties of road aggregate and Explain any two	05	CO3	L3
6	The radius of a horizontal circular curve is 10 0 meters. The design speed is 50 kmph and the design co efficient of lateral friction is 0.15 　　1) Calculate the superelevation required if full lateral friction is assumed to develop Calculate the co efficient of lateral friction needed if no superelevation is provided	08	CO4	L4
7	Describe how the quality of toughness and hardness of aggregates is evaluated in the lab	05	CO3	L4
8	List the various tests conducted on bitumen and explain any two	06	CO3	L3
9	Explain the desirable properties of subgrade soil	05	CO3	L3

D3. TEACHING PLAN - 3

Module – 5

Title:	Loop and Horn Antenna and Antenna Types	Appr Time:	10 Hrs
a	*Course Outcomes*	CO	Blooms
-	At the end of the topic the student should be able to . . .	-	Level
1	Highway drainage	CO5	L3
2	Highway economics	CO6	L4
b	*Course Schedule*	-	-
Class No	Portion covered per hour	-	-
1	Significance and requirements, Surface drainage system and design	CO5	L3
2	Examples	CO5	L4
3	Examples	CO5	L4
4	sub surface drainage system, design of filter materials	CO5	L3
5	Types of cross drainage structures, their choice and location	CO5	L3
6	Highway user benefits	CO5	L3
7	VOC using charts only-Examples	CO5	L4
8	Economic analysis - annual cost method-Benefit Cost Ratio	CO6	L4
9	method-NPV-IRR methods- Examples,	CO6	L4

10	Highway financing-BOT-BOOT concepts	CO6	L4
c	**Application Areas**	-	-
-	Students should be able employ / apply the Module learnings to . . .	-	-
1.	Highway drainage	CO5	
2.	Highway economics	CO6	
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1.	What are the requirements of highway drainage system	CO5	
2.	Describe various methods of economics analysis of a highway	CO6	
3.	Compare the annual costs of two types of pavement structures i(WBM with thin bituminous surface at total cost of rs 2.2 lakhs per km, life of 5 years, inetrest at 10%salvage value of rs 0.9 lakhs after 5 years annual average maintenance cost of rs 0.35 lakhs per km and ii(bituminous macadam and bituminous concrete surface total cost of rs 4.2 lakhs per km,life of 15 years, interest at 8%salvage value of 2 laks at the end of 15 years annual average maintenance cost rs 0.25 lakhs per km	CO6	
4.	Discuss the various components of quantifiable and non quantifiable benefits to the road users due to highway development	CO5	
e	**Experiences**	-	-
1		CO5	L4
2		CO6	

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code	17cv63	Sem:		VI	Marks:		100	Time:			
Course:	Highway engineering										
-	-	**Note: Answer all questions, each carry equal marks. Module : 5**							**Marks**	**CO**	**Level**
	1	What are the requirements of highway drainage system									
	2	Describe various methods of economics analysis of a highway									
	3	Compare the annual costs of two types of pavement structures i(WBM with thin bituminous surface at total cost of rs 2.2 lakhs per km, life of 5 years, inetrest at 10%salvage value of rs 0.9 lakhs after 5 years annual average maintenance cost of rs 0.35 lakhs per km and ii(bituminous macadam and bituminous concrete surface total cost of rs 4.2 lakhs per km,life of 15 years, interest at 8%salvage value of 2 laks at the end of 15 years annual average maintenance cost rs 0.25 lakhs per km									
	4	Discuss the various components of quantifiable and non quantifiable benefits to the road users due to highway development									

b. Assignment – 3

Model Assignment Questions									
Crs Code:	17cv63	Sem:		VI	Marks:		5/10	Time:	75 Minutes
Course:	Highway engineering								
SNo		**Assignment Description**					**Marks**	**CO**	**Level**
1		What are the requirements of highway drainage system					**06**	**CO5**	**L3**
2		Describe various methods of economics analysis of a highway					**05**	**CO6**	**L3**

3	Discuss the various components of quantifiable and non quantifiable benefits to the road users due to highway development	06	CO5	L4
4.	The maximum quantity of water expected in longitudinal drains on clayey soil is 0.9m3/sec design the cross section and longitudinal slope of trapezoidal drain assuming the bottom width of the trapezoidal section to be 1 m and cross slope to be 1 vertical to 1.5 horizontal. The allowable velocity of flow in the drain is 1.2m/sec and manning's roughness coefficient is 0.02	08	CO6	L5

F. EXAM PREPARATION

1. University Model Question Paper

Course:		Highway engineering						Month / Year	May /2018	
Crs Code:		17cv63	Sem:	VI	Marks:	80	Time:		180 minutes	
Module		Answer all FIVE full questions. All questions carry equal marks.						Marks	CO	Level
1	a	Classify the roads in India based on location and function and explain any two						5	co1	L2
	b	What are the Characteristics of road transport						5	co1	L3
	c	The area of a district is 8400 km^2 . There are 9 towns with population greater than 5000. Calculate the length of NH, SH, MDR, ODR & VR as par 3rd 20 year road plan.						6	co1	L4
		or								
	a	Classify the roads in India based on location and function and explain any two						5	co1	L2
	b	What are the Characteristics of road transport						5	co1	L3
	c	The area of a district is 8400 km^2 . There are 9 towns with population greater than 5000. Calculate the length of NH, SH, MDR, ODR & VR as par 3rd 20 year road plan.						6	co1	L4
2.	a	Explain with near sketches the various factors controlling the alignment						8	co2	L3
	b	What are the objectives of preliminary survey for highway alingment						8	co2	L2
		or								
	a	Derive an expression for finding the extra widening required on horizontal curve						8	co2	L4
	b	The speeds of overtaking and over taken vesicles are 70kmph and 40kmph respectively on a two way traffic road. The average acceleration during overtaking may be assumed as 0.99m/sec^2 calculate safe overtaking sight distance and show the details of overtaking zone with sketches						8	co2	L4
3	a	Explain how the wheel load and its repetition of loads effects the CC						08	co3	L3
	b	Write the requirements of the joints in CC pavements						08	co3	L3
		OR								
	a	Write in brief about the Design procedure of C.C. Pavement as per IRC: 38 –2002						08	co3	L3
	b	Explain with a neat sketch the mechanism of mud pumping in CC pavement constructed on clayey strata. Indicate the remedial measures						08	co3	L3
4										
	a	Explain the average growth factor method with equation						08	co4	L3
	b	Define furness method of Trip Distribution with equation						08	co4	L3
		OR								

	a	Explain with near sketches the various factors controlling the alignment	06	co4	L2
	b	What are the objectives of preliminary survey for highway alingment	05	co4	L2
	c	Derive an expression for finding the extra widening required on horizontal curve	05	co4	L3
5	a	What are the requirements of highway drainage system	08	co5	L3
	b	Describe various methods of economics analysis of a highway	08	co6	L3
		or			
	a	Discuss the various components of quantifiable and non quantifiable benefits to the road users due to highway development	08	co5	L3
	b	The maximum quantity of water expected in longitudinal drains on clayey soil is 0.9m3/sec design the cross section and longitudinal slope of trapezoidal drain assuming the bottom width of the trapezoidal section to be 1 m and cross slope to be 1 vertical to 1.5 horizontal. The allowable velocity of flow in the drain is 1.2m/sec and manning's roughness coefficient is 0.02	08	co6	L4

2. SEE Important Questions

Course:	Highway engineering				Month / Year	July/ 2018	
Crs Code:	17cv63	Sem:VI		Marks:	80	Time:	
Note	Answer all FIVE full questions. All questions carry equal marks.					-	-
Mod ule	Qno.	Important Question				**Marks**	**CO**	**Year**

Mod ule	Qno.	Important Question	Marks	CO	Year
1	a	What are the recommendations and implementations of Jayakar committee	06	co1	
	b	Explain the classification of Urban roads	05	co1	
	c	What are the different modes of transportation? Compare the characteristic features of them	05	co1	
		or			
	a	write a note i) IRC ii) CRF	08	co1	
	b	List the types of road pattern and explain any 2 with neat sketches.	08	co1	
2	a	Explain with near sketches the various factors controlling the alignment	08	co1	
	b	What are the objectives of preliminary survey for highway alingment	08	co1	
		or			
	a	Derive an expression for finding the extra widening required on horizontal curve	08	co2	
	b	The speeds of overtaking and over taken vesicles are 70kmph and 40kmph respectively on a two way traffic road. The average acceleration during overtaking may be assumed as 0.99m/sec² calculate safe overtaking sight distance and show the details of overtaking zone with sketches	08	co2	
3.	a	What are the desirable properties of aggregates? What test are conducted for judging the desirable properties? mention the significant of each test	08	co3	
	b	Briefly explain the role of pavement surface characteristics in highway geometric design	08	co3	
		or			
	a	List and explain various factors to be consider for pavements	08	co3	
	b	A Load penetration values of CBR tests conducted on a specimen of a soil sample are given below. Determine the CBR value of soil if 100 divisions of load represents 190kg and in the calibration chart of proving ring load dial readings , 0,8, 15,23,29,34,37,43,48,57,63,67	08	co3	
4	a	Explain the desirable properties of subgrade soil	08	co4	

	b	Write a note on CBR	08	co4	
		or			
	a	A plate load test was conducted on a soaked subgrade during monsoon season using a plate diameter of 30 cm. The load values corresponding to the mean settlement dial readings are given below. Determine the modulus of subgrade reaction for the standard plate.	08	co4	
	b	Enumerate the steps for the determination of modulus of subgrade reaction and for making corrections for plate size	08	co4	
5	a	What are the requirements of highway drainage system	08	co5	
	b	Describe various methods of economics analysis of a highway	08	co6	
		or			
	a	Compare the annual costs of two types of pavement structures i(WBM with thin bituminous surface at total cost of rs 2.2 lakhs per km, life of 5 years, inetrest at 10%salvage value of rs 0.9 lakhs after 5 years annual average maintenance cost of rs 0.35 lakhs per km and ii(bituminous macadam and bituminous concrete surface total cost of rs 4.2 lakhs per km,life of 15 years, interest at 8%salvage value of 2 laks at the end of 15 years annual average maintenance cost rs 0.25 lakhs per km	08	co6	
	b	Discuss the various components of quantifiable and non quantifiable benefits to the road users due to highway development	08	co5	

Course Outcome Computation

Academic Year:

Odd / Even semester

INTERNAL TEST	T1			T2			T3	
Course Outcome	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6	CO7	CO 8
QUESTION NO	Q1 LV	Q2 LV	Q3 LV	Q1 LV	Q2 LV	Q3 LV	Q1 LV	Q2 LV
MAX MARKS								
USN-1								
USN-2								
USN-3								
USN-4								
USN-5								
USN-6								
Average CO Attainment								

LV Threshold : 3:>60%, 2:>=50% and <=60%, 1: <=49%

CO1 Computation :(2+2+2+3)/4 = 10/4=2.5

PO Computation

Program Outcome	PO1	PO3	PO3	PO1	PO12	PO12	PO6	PO1
Weight of CO - PO	3	1	3	2	2	3	3	1
Course Outcome	CO1	CO2	CO3	CO4	CO5	CO6	CO7	CO8
Test/Quiz/Lab	T1			T2			T3	
QUESTION NO	Q1 LV	Q2 LV	Q3 LV	Q1 LV	Q2 LV	Q3 LV	Q1 LV	Q2 LV
MAX MARKS								
USN-1								
USN-2								
USN-3								

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USN-4	
USN-5	
USN-6	
Average CO Attainment	