



*Your Dreams Our Goal*

# POORNIMA UNIVERSITY

Member of Association of Indian Universities & Approved by UGC (Govt. of India) under 2(f) & 12(B)

## FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING  
M.TECH IN TRANSPORTATION ENGINEERING



## SCHEME & SYLLABUS BOOKLET

BATCH 2023-2025

# **SCHEME & SYLLABUS**

**BATCH: 2023-25**

# INDEX

S. No	Contents
1	Vision, Mission And Quality Policy Of University
2	Knowledge Wheel
3	Preamble
4	About Program and Program Outcomes (POs)
5	Examination System
6	Assessment & Grade Point Average: SGPA, CGPA
7	Guidelines for MOOC Courses
8	Teaching Scheme of all Semesters
9	Teaching Syllabus of all Semesters

**Disclaimer:** The scheme, syllabus and other materials published in this booklet may be changed or modified as per the requirement after approval of competent authority. The decision taken by the management of Poornima University will be final and abiding to all.

## Student Details

Name of Student:

Name of Program:

Semester:



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### ***VISION***

To create knowledge based society with scientific temper, team spirit and dignity of labor to face global competitive challenges.

### ***Mission***

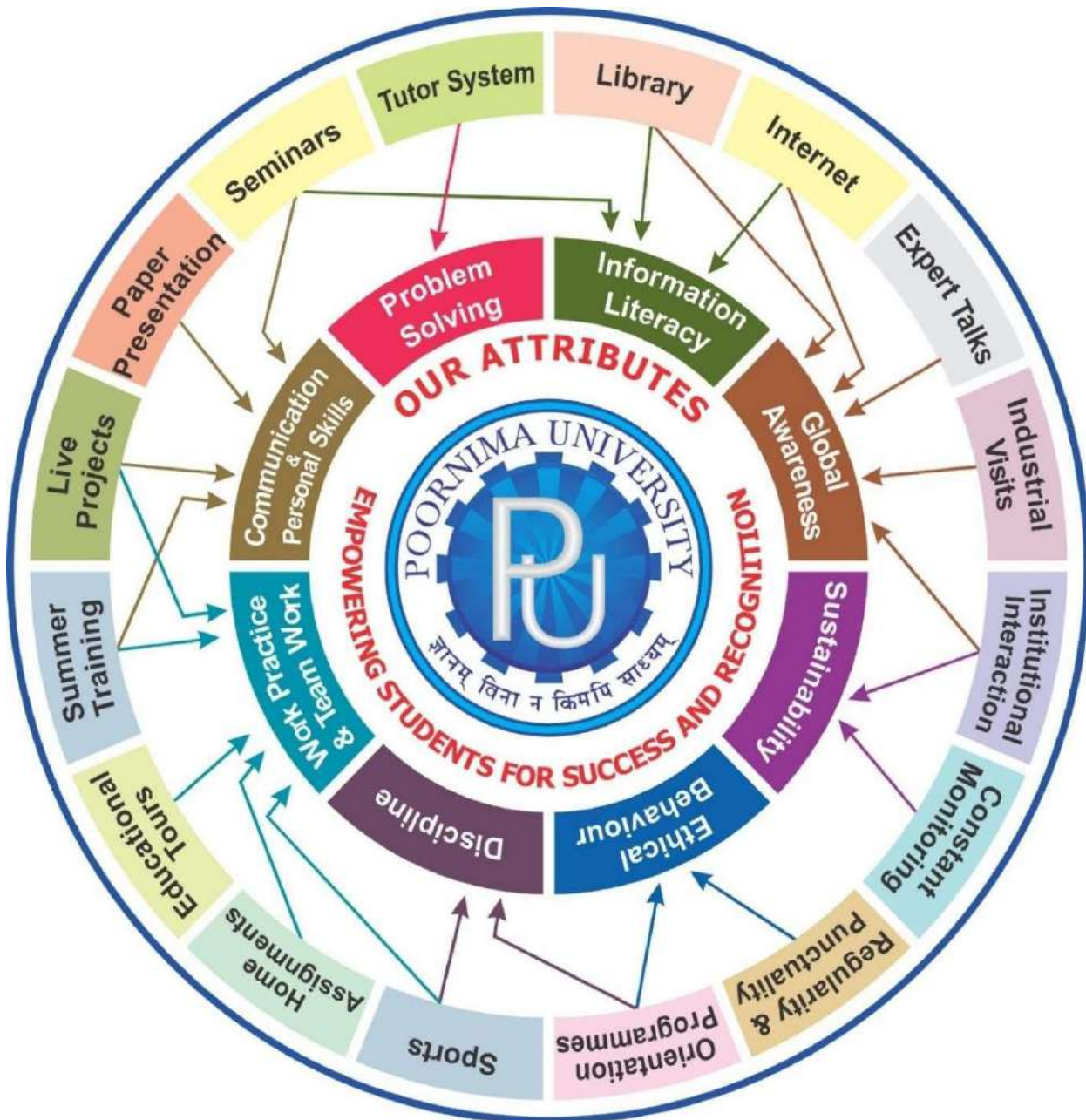
To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication and commitment to excellence in all spheres of life.

### ***Quality Policy***

To provide Quality Education through Faculty development, updating of facilities and continual improvement meeting University norms and keeping stake holders satisfied

## Knowledge Wheel

At Poornima, the academic atmosphere is a rare blend of modern technical as well as soft skills and traditional systems of learning processes.



## **About Program and Program Outcomes (PO):**

**Title of the Programme:** Bachelor of Technology (B. Tech.)

**Nature of the Programme:** B. Tech. is four year full-time programme.

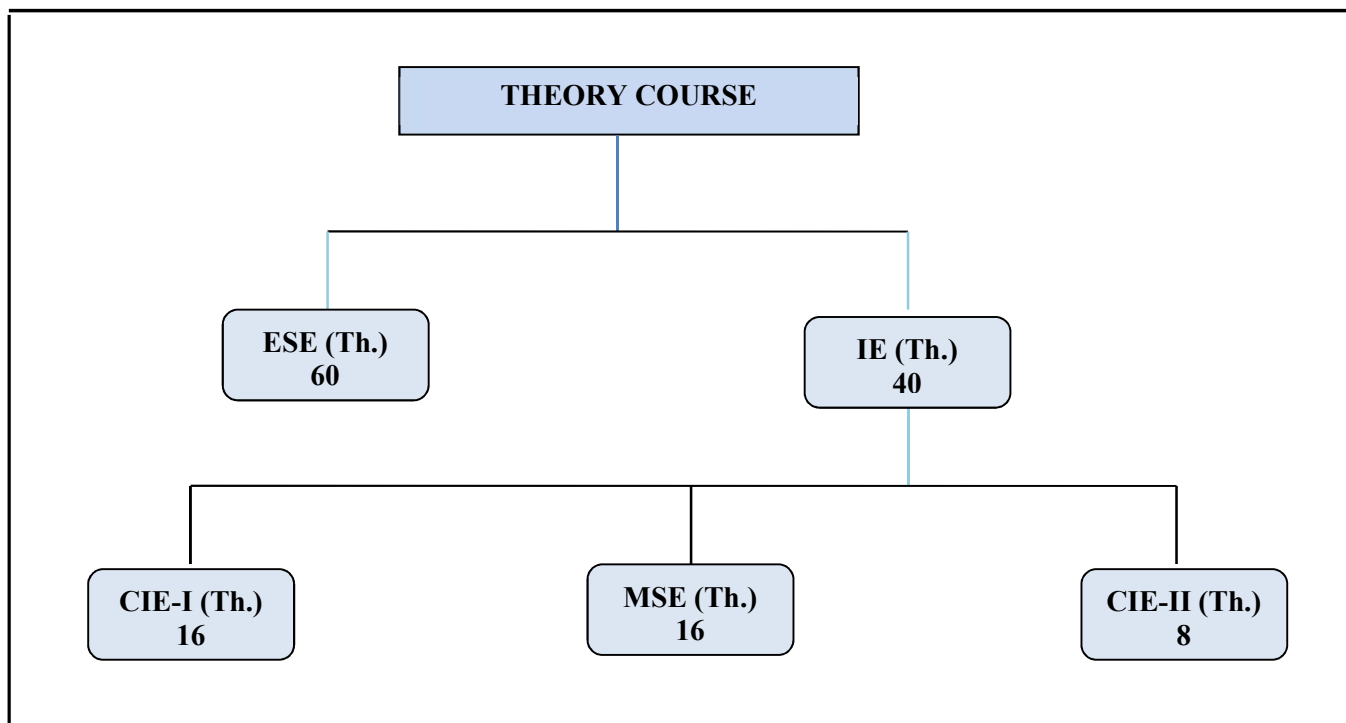
### **Program Outcomes (PO) :**

Engineering Graduates will be able to:

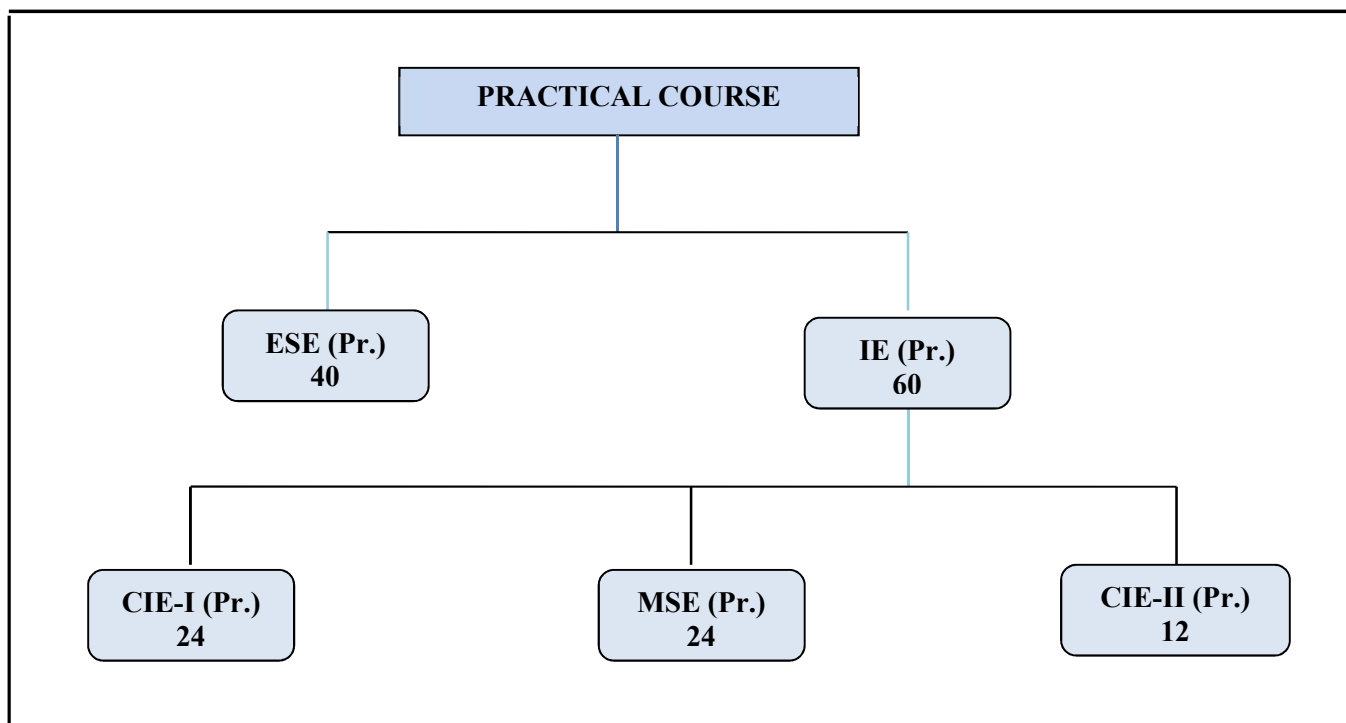
- A. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- B. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- C. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- D. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- E. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- F. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- G. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- H. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- I. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- J. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- K. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- L. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Examination System :**

**A. Marks Distribution of Theory Course:**



**B. Marks Distribution of Practical Course :**



**Th.:** Theory, **Pr.:** Practical, **ESE:** End Semester Examination, **MSE:** Mid Semester Examination, **CIE:** Continuous Internal Evaluation.

**CO Wise Marks Distribution:**

Exam Entity	Theory Subject		Practical/ Studio Subject	
	Maximum Marks	CO to be Covered	CO to be Covered	Maximum Marks
CIE-I	16 ( 8 + 8)	1 & 2	1 & 2	24 (12 + 12)
MSE	16 ( 8 + 8)	3 & 4	3 & 4	24 (12 + 12)
CIE-II (Activity/ Assignment )	8 (8)	5	5	12 (12)
ESE	60	-	-	40
TOTAL	100	-	-	100

**Minimum Passing Percentage in All Exams:**

S No.	Program Name	Minimum Passing Percentage in		
		IE Component	ESE Component	Total Component
1	Course Work for PhD Registration	-	-	50%
2	B. Arch.	-	45%	50%
3	MBA, MCA, M.Des., M.Tech., M.Plan, MHA, MPH	-	40%	40%
4	MBA, MCA, M.Des., M.Tech., M.Plan, MHA, MPH	-	35%	35%



### SGPA Calculation

$$SGPA = \frac{C_1G_1 + C_2G_2 + \dots + C_nG_n}{C_1 + C_2 + \dots + C_n}$$

$$SGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

$C_i$  is the number of credits of subject  $i$ ,

$G_i$  is the Grade Point for the subject  $i$  and  $i = 1$  to  $n$ ,

$n$  = number of subjects in a course in the semester

### CGPA Calculation

$$CGPA = \frac{C_1G_1 + C_2G_2 + \dots + C_nG_n}{C_1 + C_2 + \dots + C_n}$$

$$CGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

$C_i$  is the number of credits of subject  $i$ ,

$G_i$  is the Grade Point for the subject  $i$  and  $i = 1$  to  $n$ ,

$n$  = number of subjects in a course of all the semesters up to which CGPA is computed

## Grading Table:

Applicable for B.Arch. & Ph.D. Courses				Applicable for All Courses except B.Arch. & Ph.D.			
Academic Performance	Grade	Grade Point	Marks Range (in %)	Academic Performance	Grade	Grade Point	Marks Range (in %)
Outstanding	O	10	$90 \leq x \leq 100$	Outstanding	O	10	$90 \leq x \leq 100$
Excellent	A+	9	$80 \leq x < 90$	Excellent	A+	9	$80 \leq x < 90$
Very Good	A	8	$70 \leq x < 80$	Very Good	A	8	$70 \leq x < 80$
Good	B+	7	$60 \leq x < 70$	Good	B+	7	$60 \leq x < 70$
Above Average	B	6	$50 \leq x < 60$	Above Average	B	6	$50 \leq x < 60$
Fail	F	0	$x < 50$	Average	C	5	$40 \leq x < 50$
Absent	Ab	0	Absent	Pass	P	4	$35 \leq x < 40$
				Fail	F	0	$x < 35$
				Absent	Ab	0	Absent

### CGPA to percentage conversion rule:

$$\text{Equivalent \% of Marks in the Program} = \text{CGPA} * 10$$

### Award of Class

CGPA	Percentage	Equivalent Division
$7.50 \leq \text{CGPA}$	75% or more	First Division with Distinction
$6.00 \leq \text{CGPA} < 7.50$	$60\% \leq x < 75\%$	First Division
$5.00 \leq \text{CGPA} < 6.00$	$50\% \leq x < 60\%$	Second Division
$4.00 \leq \text{CGPA} < 5.00$	$40\% \leq x < 50\%$	Pass Class

# **Guidelines for Massive Open Online Courses (MOOCs)**

## **(Session 2023-24)**

Poornima University, in its never ending endeavor to equip students with best-of-class learning and knowledge, has undertaken to include MOOC courses as part of its credit scheme from session 2023-24 onwards. The objective behind this is to enable students to study courses designed by the best teachers in the country and to scale their knowledge base with the rest of learners from the nation. The MOOCs which are included under this scheme is can be chosen from SWAYAM and NPTEL.

### **1. Introduction of MOOCs: SWAYAM and NPTEL**

#### **About SWAYAM:**

SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

This is done through a platform that facilitates hosting of all the courses, taught in classrooms to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to any learner. However learners wanting a SWAYAM certificate should register for the final proctored exams that come at a fee and attend in-person at designated centers on specified dates. Eligibility for the certificate will be announced on the course page and learners will get certificates only if this criteria is matched.

The courses hosted on SWAYAM are in 4 quadrants – (1) video lecture, (2) specially prepared reading material that can be downloaded/printed (3) self-assessment tests through tests and quizzes and (4) an online discussion forum for clearing the doubts. Steps have been taken to enrich the learning experience by using audio-video and multi-media and state of the art pedagogy / technology.

In order to ensure that best quality content is produced and delivered, nine National Coordinators have been appointed. They are:

1. AICTE (All India Council for Technical Education) for self-paced and international courses
2. NPTEL (National Programme on Technology Enhanced Learning) for Engineering
3. UGC (University Grants Commission) for non-technical post-graduation education
4. CEC (Consortium for Educational Communication) for under-graduate education
5. NCERT (National Council of Educational Research and Training) for school education
6. NIOS (National Institute of Open Schooling) for school education
7. IGNOU (Indira Gandhi National Open University) for out-of-school students
8. IIMB (Indian Institute of Management, Bangalore) for management studies
9. NITTTR (National Institute of Technical Teachers Training and Research) for Teacher Training programme

Two types of courses are offered on SWAYAM platform: Credit Courses and Non- Credit Courses. Credit courses are offered for each semester in January and July every year. The list is available on SWAYAM official website: <https://onlinecourses.swayam2.ac.in/>

#### **About NPTEL:**

NPTEL (National Programme on Technology Enhanced Learning), is a joint venture of the IITs and IISc, funded by the Ministry of Education (MoE) Government of India, and was launched in 2003. Initially started as a project to take quality education to all corners of the country, NPTEL now offers close to 600+ courses for certification every semester in about 22 disciplines.

#### **Some highlights:**

- Largest online repository in the world of courses in engineering, basic sciences and selected humanities and management subjects
- YouTube channel for NPTEL – most subscribed educational channel, 1.3 billion views and 40+ lakhs subscribers

- More than 56000 hours of video content, transcribed and subtitled
- Most accessed library of peer-reviewed educational content in the world
- Translation of more than 12000 hrs of English transcripts in regional Indian languages

### **NPTEL Online Certification:**

The objective of enabling students obtain certificates for courses is to make students employable in the industry or pursue a suitable higher education programme. Through an online portal, 4, 8, or 12-week online courses, typically on topics relevant to students in all years of higher education along with basic core courses in sciences and humanities with exposure to relevant tools and technologies, are being offered. Enrolment to and learning from these courses is free. Following these online courses, an in-person, proctored certification exam is conducted and a certificate is provided through the participating institutions and industry, as applicable.

Some statistics regarding the open online courses since March 2014 till Dec 2021

Completed courses: 3496;

Enrollments across courses: 1.58 CRORE +

Number of exam registrations: 15.1 LAKH +

All the statistics pertaining to completed courses are available at <https://beta.nptel.ac.in/courses>.

All courses are completely free to enroll and learn from. The certification exam is optional and comes at a fee of Rs 1000/course exam.

## **2. MOOCs at Poornima University:**

MOOCs envelops best in class teaching - learning processes along with meeting the requirements of various courses in terms of quality of teaching and evaluation system. To promote the MOOCs among students of Poornima University, it is decided to consider the credits earned through MOOCs.

### **(a) Options for MOOCs at Poornima University**

**(For this document, only those MOOCs will be considered which are available on SWAYAM & NPTEL platforms)**

- Credit and Non-credit SWAYAM MOOCs can be opted by anyone, anytime, anywhere and in any language. However, prior-permission of the University Authorities is mandatory if the credits are to be transferred to regular degree.
- In case of credit courses, there are two ways to opt these courses for the purpose of credit transfer to PU system as given below:

### **OPTION-I: As Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards):**

Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards) are available at University level in offline mode for which relevant booklets are already published. **These courses carries 02 credits.** These category/type of courses (similar/different) are also available as MOOC courses. The respective Deans / HODs shall provide both the options to all the students to either select offline courses or MOOCs as per details given below:

- Deans / HODs shall prepare a list of upto 05 appropriate MOOC courses of 02/03 credits each, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.
- After approval, the respective Deans / HODs shall circulate a notice to all their respective students so that they can select any one course from the list, the credits (**only 02**) of which will be counted against Open Elective/ Multidisciplinary courses pertaining to that particular semester.
- If the students are not willing to opt for MOOC Open Elective/ Multidisciplinary course, they can proceed with the current offline practice of opting for Multidisciplinary courses.
- The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean.

## OR

### **OPTION-II: As Major / Minor Courses:**

- Deans / HODs shall identify a course of **03 credits** for each semester, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.
- After approval, the respective Deans / HODs shall circulate a notice to all their respective students citing that the particular course will be conducted through MOOCs only and is compulsory for all respective students. The credits of this course will be counted against Major/Minor courses pertaining to that particular semester.
- The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean.
- This is to be noted that if Deans / HODs decide to conduct any major/minor course in any semester through MOOCs, no offline course will be conducted against that.

### **(b) Important points related to MOOCs at Poornima University**

- Only one MOOC shall be allowed in a particular semester for the purpose of credit transfer in the beginning.
- No attendance will be taken for MOOC courses.
- Last period of T/T/S shall be taken for MOOC courses which shall be in self-study mode.
- The method of assessments of MOOC such as assignments and examination are completely associated with that particular MOOC and no exam will be conducted by the department as well as by the Examination Cell.
- The respective Dean / HOD must submit the detail of course i.e., code, name and credit of MOOC opted against that particular course in particular semester attached with highlighting in the related examination scheme of syllabus of that semester signed by BOS Convener / HoD and Dean of Faculty to the office of Pro-President before commencement of the classes.
- SWAYAM will award a certificate to all the students passing the examination along with the credit earned. The center of examination for SWAYAM MOOCs will be finalized by SWAYAM. All the responsibility related to registration for MOOCs, timely submission of assignments, examinations etc. will be borne by the students only.
- The list of registered students in MOOC along with name of course will be submitted to the Examination Cell by the Deans / HoDs before commencement of the classes.
- Any student who would not be able to register/present/clear/pass the MOOC in the stipulated time, it is the choice of the student that he or she may register in next semester (odd or even) with MOOC again or appear as a back exam candidate of the University as per PU norms.
- There will be no provision of re-evaluation of MOOC.
- The scorecard and related certificate of MOOC along with a consolidated list of students with marks of assignment and final exam will be submitted to the examination cell by the concerned Dean / HOD for further process. It is also recommended that alteration/changes/scaling in marks obtained by the students in any MOOC will not be considered.
- The exam registration fee of MOOC up to Max. INR 1000/- will be reimbursed to the student only after successful completion of the course in first attempt and submission of the fee receipt, score-card and certificate of the MOOC to the concerned department within stipulated time after declaration of the results.

**NOTE: This is to be noted that the procedure for getting approval from BOS, Faculty Board, Academic Council and BoM is to be followed as per regular process.**

**Attached Items:**

Open Elective Booklet	Annexure-1
Soft Skills Booklet	Annexure-2
Value Added Course Booklet	Annexure-3

**Required credits for Honors:**

S.No	Program Duration	Required credits for Honors
1.	2- Year	10- Credits
2.	3- Year	15- Credits
3.	4-Year	20- Credits

S. No	NPTEL/ SWAYAM Course duration (in weeks)	Equivalent Credits
1	4	2
2	8	3
3	12	4

**Attached Items:**

Open Elective Booklet	Annexure-1
Soft Skills Booklet	Annexure-2
Value Added Course Booklet	Annexure-3

POORNIMA UNIVERSITY, JAIPUR										
Faculty of Engineering and Technology										
Name of Program:	M.Tech. in Transportation Engineering			Duration: 2 Years			Total Credits: 80			
Teaching Scheme for Batch 2023-25										
Semester-I										
Course Code	Name of Course	Teaching Scheme				Marks Distribution			Credits	
		Lecture (L)	Tutorial (T)	Practical	SH	IE	ESE	Total		
<b>A. Major (Core Courses)</b>										
<b>A.1</b>	<b>Theory</b>									
MTECCV1101	Numerical Methods and Applied Statistics	3	1	-	-	40	60	100	4	
MTECCV1102	Pavement Analysis and Design	3	1	-	-	40	60	100	4	
<b>A.2</b>	<b>Practical</b>									
MTECCV1201	Transportation Engineering Lab-I	-	-	2		60	40	100	1	
<b>B. Minor Stream Courses/ Department Electives I and II</b>										
<b>B.1</b>	<b>Theory</b>									
MTEECV1101	Geo-spatial Techniques			-	-	40	60	100	4	
MTEECV1102	Bridge Engineering	3	1	-	-	40	60	100		
MTEECV1103	Advanced Highway Materials			-	-	40	60	100		
MTEECV1104	Traffic Flow Theory			-	-	40	60	100	4	
MTEECV1105	Project Management	3	1	-	-	40	60	100		
MTEECV1106	Transportation Systems			-	-	40	60	100		
<b>B.2</b>	<b>Practical</b>									
	-	-	-	-	-	-	-	-	-	
<b>C. Multidisciplinary Courses</b>										
		-	-	-	-	-	-	-	-	
<b>D. Ability Enhancement Courses (AEC)</b>										
MULCHM1201	Soft Skills - I	-	-	2		60	40	100	1	
<b>E. Skill Enhancement Courses (SEC)</b>										
MULCSE1201	Skill Enhancement Technical Course			2		60	40	100	1	
<b>F. Value Added Courses (VAC)</b>										
	-	-	-	-	-	-	-	-	-	
<b>G. Summer Internship / Research Project / Dissertation</b>										
MTECCV1401	Seminar-I	-	-	4		60	40	100	2	
<b>Total</b>		12	4	10					<b>21</b>	
<b>Total Teaching Hours</b>		<b>26</b>								

		POORNIMA UNIVERSITY, JAIPUR							
		Faculty of Engineering and Technology							
Name of Program:	M.Tech. in Transportation Engineering		Duration: 2 Years			Total Credits: 80			
		Teaching Scheme for Batch 2023-25							
		Semester-II							
Course Code	Name of Course	Teaching Scheme				Marks Distribution			Credits
		Lecture (L)	Tutorial (T)	Practical	SH	IE	ESE	Total	
<b>A.</b>		<b>Major (Core Courses)</b>							
<b>A.1</b>	<b>Theory</b>								
MTECCV2101	Highway Traffic Analysis and Design	3	1	-		40	60	100	4
MTECCV2102	Highway Construction Practice	3	1	-		40	60	100	4
<b>A.2</b>	<b>Practical</b>								
MTECCV2201	Transportation Engineering Lab-II	-	-	2		60	40	100	1
<b>B.</b>		<b>Minor Stream Courses/ Department Electives I and II</b>							
<b>B.1</b>	<b>Theory</b>								
MTEECV2101	Analysis of Transportation Systems	3	1	-	-	40	60	100	4
MTEECV2102	Transportation Planning			-	-	40	60	100	
MTEECV2103	Environmental Impact Assessment			-	-	40	60	100	
MTEECV2104	Transportation Network Analysis and Optimization	3	0	-	-	40	60	100	3
MTEECV2105	Transportation Project Evaluation and Decision Making			-	-	40	60	100	
MTEECV2106	Intelligent Transportation Systems			-	-	40	60	100	
<b>B.2</b>	<b>Practical</b>								
	-	-	-	-	-	-	-	-	-
<b>C</b>		<b>Multidisciplinary Courses</b>							
MULEBX2109	Engineering Economics	3	-	-	-	40	60	100	3
<b>D</b>		<b>Ability Enhancement Courses (AEC)</b>							
MULCHM2201	Soft Skills - II	-	-	2		60	40	100	1
<b>E</b>		<b>Skill Enhancement Courses (SEC)</b>							
MULCSE2201	Skill Enhancement Technical Course-II	-	-	2		60	40	100	1
<b>F</b>		<b>Value Added Courses (VAC)</b>							
	-	-	-	-	-	-	-	-	-
<b>G</b>		<b>Summer Internship / Research Project / Dissertation</b>							
MTECCV2401	Seminar-II	-	-	2	-	60	40	100	1
<b>Total</b>		15	3	8					<b>22</b>
<b>Total Teaching Hours</b>		<b>26</b>							<b>22</b>



		POORNIMA UNIVERSITY, JAIPUR								
		Faculty of Engineering and Technology								
Name of Program:	M.Tech. in Transportation Engineering		Duration: 2 Years			Total Credits: 80				
		Teaching Scheme for Batch 2023-25								
		Semester-III								
Course Code	Name of Course	Teaching Scheme				Marks Distribution				Credits
		Lecture (L)	Tutorial (T)	Practical	SH	IE	ESE	Total		
<b>A.</b>		<b>Major (Core Courses)</b>								
<b>A.1</b>	<b>Theory</b>									
MTECCV3101	Pavement Materials	3	1	-		40	60	100	4	
MTECCV3102	Research Methodology	3	1	-		40	60	100	4	
<b>A.2</b>		<b>Practical</b>								
MTECCV3201	Transportation Lab-III	-	-	2		60	40	100	1	
MTECCV3401	Review/Research Paper	-	-	2		60	40	100	1	
<b>B.</b>		<b>Minor Stream Courses/ Department Electives/ <i>Open Elective</i></b>								
<b>B.1</b>		<b>Theory</b>								
MULEEE3107	E-Commerce and Knowledge Management	3	1	-		40	60	100	3	
MULECV3108	Water and Environmental Pollution			-		40	60	100		
MULEME3109	IPR & Patents			-		40	60	100		
MULEEE3110	Robotics			-		40	60	100		
MULEEE3111	Digital India Implementation			-		40	60	100		
MULECV3112	Smart City Design			-		40	60	100		
MULEEE3113	Renewable Energy			-		40	60	100		
<b>B.2</b>		<b>Practical</b>								
<b>C</b>		<b>Multidisciplinary Courses</b>								
MSTEMC3121	MOOC Course - I	3	-	-	-	-	-	-	3	
<b>D</b>		<b>Ability Enhancement Courses (AEC)</b>								
<b>E</b>		<b>Skill Enhancement Courses (SEC)</b>								
-	-	-	-	-	-	-	-	-	-	
<b>F</b>		<b>Value Added Courses (VAC)</b>								
<b>G</b>		<b>Summer Internship / Research Project / Dissertation</b>								
MTECCV3402	Dissertation Part - I	-	-	12	-	60	40	100	6	
<b>Total</b>		12	3	16					<b>22</b>	
<b>Total Teaching Hours</b>		<b>31</b>							<b>22</b>	

	<b>POORNIMA UNIVERSITY, JAIPUR</b>									
	<b>Faculty of Engineering and Technology</b>									
<b>Name of Program:</b>	<b>M.Tech. in Transportation Engineering</b>			<b>Duration: 2 Years</b>			<b>Total Credits: 80</b>			
	<b><u>Teaching Scheme for Batch 2023-25</u></b>									
	<b>Semester-IV</b>									
Course Code	Name of Course	Teaching Scheme				Marks Distribution				Credits
		Lecture (L)	Tutorial (T)	Practical	SH	IE	ESE	Total		
<b>A.</b>		<b>Major (Core Courses)</b>								
<b>A.1</b>	<b>Theory</b>									
-	-	-	-	-	-	-	-	-	-	-
<b>A.2</b>	<b>Practical</b>									
-	-	-	-	-	-	-	-	-	-	-
<b>B.</b>		<b>Minor Stream Courses/ Department Electives/ <i>Core Elective</i></b>								
<b>B.1</b>	<b>Theory</b>									
-	-	-	-	-	-	-	-	-	-	-
<b>B.2</b>	<b>Practical</b>									
-	-	-	-	-	-	-	-	-	-	-
<b>C</b>		<b>Multidisciplinary Courses</b>								
-	-	-	-	-	-	-	-	-	-	-
<b>D</b>		<b>Ability Enhancement Courses (AEC)</b>								
-	-	-	-	-	-	-	-	-	-	-
<b>E</b>		<b>Skill Enhancement Courses (SEC)</b>								
-	-	-	-	-	-	-	-	-	-	-
<b>F</b>		<b>Value Added Courses (VAC)</b>								
-	-	-	-	-	-	-	-	-	-	-
<b>G</b>		<b>Summer Internship / Research Project / Dissertation</b>								
MTECCV4401	Dissertation Part - II	-	-	30		250	250	500		15
<b>Total</b>		0	0	30						<b>15</b>
<b>Total Teaching Hours</b>		<b>30</b>								<b>15</b>



POORNIMA UNIVERSITY, JAIPUR										
Faculty of Engineering and Technology										
Name of Program:	M.Tech. in Transportation Engineering			Duration: 2 Years			Total Credits: 80			
Teaching Scheme for Batch 2023-25										
Semester-I										
Course Code	Name of Course	Teaching Scheme				Marks Distribution			Credits	
		Lecture (L)	Tutorial (T)	Practical	SH	IE	ESE	Total		
<b>A.</b>	<b>Major (Core Courses)</b>									
<b>A.1</b>	<b>Theory</b>									
MTECCV1101	Numerical Methods and Applied Statistics	3	1	-	-	40	60	100	4	
MTECCV1102	Pavement Analysis and Design	3	1	-	-	40	60	100	4	
<b>A.2</b>	<b>Practical</b>									
MTECCV1201	Transportation Engineering Lab-I	-	-	2		60	40	100	1	
<b>B.</b>	<b>Minor Stream Courses/ Department Electives I and II</b>									
<b>B.1</b>	<b>Theory</b>									
MTEECV1101	Geo-spatial Techniques	3	1	-	-	40	60	100	4	
MTEECV1102	Bridge Engineering			-	-	40	60	100		
MTEECV1103	Advanced Highway Materials			-	-	40	60	100		
MTEECV1104	Traffic Flow Theory	3	1	-	-	40	60	100	4	
MTEECV1105	Project Management			-	-	40	60	100		
MTEECV1106	Transportation Systems			-	-	40	60	100		
<b>B.2</b>	<b>Practical</b>									
	-	-	-	-	-	-	-	-	-	
<b>C</b>	<b>Multidisciplinary Courses</b>									
		-	-	-	-	-	-	-	-	
<b>D</b>	<b>Ability Enhancement Courses (AEC)</b>									
MULCHM1201	Soft Skills - I	-	-	2		60	40	100	1	
<b>E</b>	<b>Skill Enhancement Courses (SEC)</b>									
MULCSE1201	Skill Enhancement Technical Course			2		60	40	100	1	
<b>F</b>	<b>Value Added Courses (VAC)</b>									
	-	-	-	-	-	-	-	-	-	
<b>G</b>	<b>Summer Internship / Research Project / Dissertation</b>									
MTECCV1401	Seminar-I	-	-	4		60	40	100	2	
<b>Total</b>		12	4	10					<b>21</b>	
<b>Total Teaching Hours</b>		<b>26</b>								

**M. Tech.**  
**TRANSPORTATION ENGINEERING**  
**Syllabus – First Semester**

**Code: MTECCV1101 Numerical Methods and Applied Statistics**

**4 Credits [LTP: 3-1-0]**

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO01101.1	Apply the basic concepts of probability, random variables, probability distribution.
CO01101.2	Compute and interpret descriptive statistics using numerical and graphical techniques
CO01101.3	Use statistical methodology and tools in the engineering problem solving process.
CO01101.4	Apply the basic concepts of regression and curve fitting and calculate finite differences of tabulated data.
CO01101.5	Analyze the one way two way variance classification

**A. DETAILED SYLLABUS**

Unit	Unit details
<b>Unit 1</b>	Linear system-Gaussian elimination and Gauss-Jordan methods-matrix inversion-Gauss seidel method-Nonlinear equations-Regulafalsi and Newton-Raphson methods interpolation-Newton's and Lagrange's interpolation
<b>Unit 2</b>	Linear Programming – Graphical and Simplex methods – Measures of central tendency, dispersion, skewness and Kurtosis – Probability – conditional probability – Bayes' theorem
<b>Unit 3</b>	Random variable – two dimensional random variables – standard probability distributions – Binomial Poisson and normal distributions - moment generating function, Sampling distributions – confidence interval estimation of population parameters – testing of hypotheses
<b>Unit 4</b>	Large sample tests for mean and proportion – t-test, F-test and Chi-square test – curve fitting-method of leastsquares
<b>Unit 5</b>	Regression and correlation – rank correlation – multiple and partial correlation – analysis of variance-one way and two way classifications – experimental design – Latin square design – Time series analysis.

**B. RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Author
1.	Engineering Statistics, Prentice-Hall, 1972	Bowker and Liberman
2.	Numerical Methods in Science and Engineering, National Publisher Company.	Venkatraman, M.K.

S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/122/102/122102009/">https://nptel.ac.in/courses/122/102/122102009/</a>
2.	<a href="https://nptel.ac.in/courses/111/107/111107105/">https://nptel.ac.in/courses/111/107/111107105/</a>

**D. COs and Pos Mapping**

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1101.1	1	1	-	3	-	1	-	-	-	-	1	-
CO1101.2	1	3	-	2	1	-	-	-	-	-	-	-
CO1101.3	1	-	-	3	1	-	-	-	-	-	1	-
CO1101.4	1	1	3	-	-	-	1	-	-	-	1	-
CO1101.5	1	1	3	-	1	1	-	-	-	-	-	1

**E. COs AND PSOs MAPPING**

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1101.1	1	2	3	1	-
CO1101.2	-	2	2	-	3
CO1101.3	1	1	-	3	2

**COURSE OVERVIEW AND OBJECTIVES:**

This course deals with the pavement analysis and design. In this course the students learn the process of characterizing the pavement material, analyzing the design factors of the pavement, designing flexible and rigid pavement and handling road service management.

**A. COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO01102.1	Analyze the pavement and the pavement materials.
CO01102.2	Evaluate pavement design factors for deciding quantity of different components of pavement.
CO01102.3	Design flexible pavement by IRC,AASHTO and Mechanistic-Empirical Methods.
CO01102.4	Design rigid pavement and joints by IRC and AASHTO Methods.
CO01102.5	Interpret post performance of pavement.

**B. DETAILED SYLLABUS**

<b>Unit 1</b>	Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airfield pavements, Requirements and desirable properties of aggregates, bitumen, emulsion and modified bitumen, Characterization of different pavement materials
<b>Unit 2</b>	Pavement Design Factors Design wheel load, strength characteristics of pavement materials, climatic variations, traffic - load equivalence factors and equivalent wheel loads, aircraft loading, gear configuration and tyre pressure. Drainage-Estimation of flow, surface drainage, sub-surface drainage systems, design of sub-surface drainage structures
<b>Unit 3</b>	Flexible Pavement Design Empirical, semi-empirical and theoretical approaches, design of highway and airport pavements by IRC,AASHTO Methods, Mechanistic-Empirical design, applications of pavement design software
<b>Unit 4</b>	Rigid Pavement Design Types of joints and their functions, joint spacing; design of CC pavement for roads, highways and airports as per IRC, AASHTO, design of joints. Design of continuously reinforced concrete pavements. Reliability; Use of software for rigid pavement design
<b>Unit 5</b>	Pavement Management Distresses in pavements, maintenance of highways, structural and functional condition evaluation of pavements, performance prediction models, ranking and optimization in pavement management.

**C. RECOMMENDED STUDYMATERIAL:**

S. No	Title of the Book	Author
1.	Principles of Pavement Design	Yoder and Witczak, John Wiley and Sons
2.	Pavement Analysis and Design,	Yang. H. Huang, Prentice Hall Inc.
3.	Pavement Engineering –	Rajib B. Mallick and Tahar El-Korchi, CRC
4.	Modern Pavement Management	W.Ronald Hudson, Ralph Haas and Zeniswki, Mc

S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/105/105/105105107/">https://nptel.ac.in/courses/105/105/105105107/</a>
2.	<a href="https://www.youtube.com/watch?v=uJntLOgEHD4">https://www.youtube.com/watch?v=uJntLOgEHD4</a>



**D. COs AND POs MAPPING**

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1102.1	1	1	1	-	-	2	1	-	-	-	-	1
CO1102.2	1	1	2	1	1	-	1	-	-	-	-	-
CO1102.3	1	1	3	1	1	-	-	-	1	-	-	-
CO1102.4	1	1	3	-	-	-	1	-	1	1	1	-
CO1102.5	1	1	3	-	1	1	-	-	-	-	-	1

**E. COs AND PSOs MAPPING**

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1102.1	2	3	-	-	1
CO1102.2	1	3	-	2	1
CO1102.3	3	1	1	1	-
CO1102.4	3	2	2	-	-
CO1102.5	3	2	-	-	2

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

**Code: MTECCV1201****Transportation Engineering Lab-I****1 Credits [LTP: 0-0-2]****A. DETAILED SYLLABUS****List of Experiments**

Design as per syllabus of theory

S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/105/107/105107123/">https://nptel.ac.in/courses/105/107/105107123/</a>

**D. COs AND POs MAPPING**

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1201.1	1	1	1	-	-	2	1	-	-	-	-	1
CO1201.2	1	1	2	1	1	-	1	-	-	-	-	-
CO1201.3	1	1	3	1	1	-	-	-	1	-	-	-
CO1201.4	1	1	3	-	-	-	1	-	1	1	1	-
CO1201.5	1	1	3	-	1	1	-	-	-	-	-	1

**E. COs AND PSOs MAPPING**

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1201.1	2	3	-	-	1
CO1201.2	1	3	-	2	1
CO1201.3	3	1	1	1	-
CO1201.4	3	2	2	-	-
CO1201.5	3	2	-	-	2

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

## Department Elective Course-I

**Code: MTEECV1101**

**Geo-spatial Techniques**

**4 Credits [LTP: 3-1-0]**

### COURSE OUTCOME

After completion of this course, student will be able to:

CO No.	Description
CO1101.1	Analyze the EMS, EMR, Spectral Signature curves, Data interpretation and Photogrammetry using Radar, LIDAR, and SAR systems.
CO1101.2	Demonstrate satellite system and sensor parameters.
CO1101.3	Draw map using GIS system.
CO1101.4	Design the working process of GIS and Space Geodetic Techniques.
CO1101.5	Apply GIS in Transportation planning, Infrastructure development, Structural, Geotechnical, Earthquake, Environmental and Water resource Engineering.

### A. DETAILED SYLLABUS

<b>Unit 1</b>	Concepts and foundations of remote sensing – energy source EMS – Remote Sensing System – EMR interaction with particulate matter – Spectral Signature curves – Data Acquisition and interpretation – Visual Image Interpretation – Photogrammetry – Radar, LIDAR, SAR systems
<b>Unit 2</b>	Platform/Sensors – Classification – satellite system/sensor parameters – earth resources and meteorological satellites – microwave remote sensing techniques – Data Processing – Digital Image processing – Characteristics of Digital Satellite Image – groundtruthing
<b>Unit 3</b>	History of Development – Maps – Types of Maps, Projections – Components/Architecture of GIS – Data Spatial and Non-Spatial – Data Input Sources – Raster and Vector data structures DBMS –Data Output – Data quality – Sources/ types of errors
<b>Unit 4</b>	Data handling in GIS –processing, analysis and Modeling – Raster and Vector spatial analysis Density analysis– Spatial autocorrelation – network analysis – nearest neighbor analysis – Surface modeling – DTM – Introduction to Geodesy – Space Geodetic Techniques
<b>Unit 5</b>	GPS Application of Remote Sensing, GIS and GPS – Survey, mapping and monitoring – Transportation planning – Infrastructure development – Structural engineering – Geotechnical Engineering – Earthquake Engineering –Environmental studies – Water resources

### B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1	Concepts and Techniques of Geographical	C.P. Lo and Albert K. W. Yeung, Prentice– Hall India,
2	Remote Sensing and Image Interpretation	Thomas. M. Lillesand and Ralph. W. Kiefer, John Wiley and Sons, 2003
3	Fundamentals of Remote Sensing	Joseph G., University Press, 2005
4	Geographical Information systems	Panigrahi, N., University Press, 2005

S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/105/107/105107155/">https://nptel.ac.in/courses/105/107/105107155/</a>
2.	<a href="https://nptel.ac.in/courses/121/107/121107009/">https://nptel.ac.in/courses/121/107/121107009/</a>

#### D. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1101.1	1	1	1	-	-	2	1	-	-	-	-	1
CO1101.2	1	1	2	1	1	-	1	-	-	-	-	-
CO1101.3	1	1	3	1	1	-	-	-	1	-	-	-
CO1101.4	1	1	3	-	-	-	1	-	1	1	1	-
CO1101.5	1	1	3	-	1	1	-	-	-	-	-	1

#### E. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1101.1	2	3	-	-	1
CO1101.2	1	3	-	2	1
CO1101.3	3	1	1	1	-
CO1101.4	3	2	2	-	-
CO1101.5	3	2	-	-	2

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

**COURSE OVERVIEW AND OBJECTIVES**

This course facilitates the students to learn different type of bridge on the basis of shape size and functions. In this course students learn the designing of various components of the bridge systems.

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO1102.1	Demonstrate bridges on the basis of their importance and site selection.
CO1102.2	Evaluate the width of carriageway, loads and Impact effect.
CO1102.3	Design of culvert, Foot Bridge, Slab Bridge, T-beam bridge, Pre-stressed concrete bridge, Box Culvert and Fly over bridges.
CO1102.4	Analyze the Pier, abutments caps and foundations.
CO1102.5	Interpret the bearings and the joints in the bridge.

**DETAILED SYLLABUS**

<b>Unit 1</b>	Components of Bridges – Classification – Importance of Bridges – Investigation for Bridges – Selection of Bridge site – Economical span – Location of piers and abutments – Subsoil exploration – Scour depth – Traffic projection – Choice of bridge type
<b>Unit 2</b>	Specification of road bridges – width of carriageway – loads to be considered – dead load – IRC standard live load – Impact effect
<b>Unit 3</b>	General design considerations – Design of culvert – Foot Bridge - Slab Bridge – T-beam bridge – Pre-stressed concrete bridge – Box Culvert - Fly over bridges
<b>Unit 4</b>	Evaluation of sub structures – Pier and abutments caps – Design of pier – Abutments Type of foundations
<b>Unit 5</b>	Importance of Bearings – Bearings for slab bridges – Bearings for girder bridges – Electrometric bearing – Joints – Expansion joints. Construction and Maintenance of bridges – Lessons from bridge failures

**RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Author
1.	Bridge Engineering	Ponnuswamy, Tata McGraw - Hill, New Delhi, 1997
2.	Essentials of Bridge Engineering	Victor, D.J., Oxford & IBH Publishers Co., New Delhi, 1980
3.	Bridge Superstructure	N. Rajagopalan, Narosa Publishing House, New Delhi, 2006

S. No	Important web links
1.	<a href="https://swayam.gov.in/nd1_noc19_ce23/preview">https://swayam.gov.in/nd1_noc19_ce23/preview</a>
2.	<a href="https://nptel.ac.in/courses/105/105/105105165/">https://nptel.ac.in/courses/105/105/105105165/</a>

#### D. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1102.1	3	2		1	-	-	-	-	-	-	-	-
CO1102.2	2	2	1	2	-	-	-	-	-	-	-	-
CO1102.3	2	3	-	1	-	-	-	-	-	-	-	-
CO1102.4	2	-	3	-	1	-	-	-	-	-	-	-
CO1102.5	2	2	2	1	-	-	-	-	-	-	-	-

#### E.COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1102.1	3	-	2	-	1
CO1102.2	2	3	-	1	-
CO1102.3	1	2	3	1	-
CO1102.4	-	2	2	-	3
CO1102.5	1	1	-	3	2

**Note:** On the basis of mapping of COs with POs, this course is related to Employability

**A. COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO1103.1	Analyze Aggregate Nature and properties for pavement, bituminous, Portland Cement Concrete and light weight.
CO1103.2	Demonstrate conventional and modified binders.
CO1103.3	Design the mix of concrete materials for High Performance Concrete with low shrinkage.
CO1103.4	Interpret Composites, Plastics, Geo-synthetics Plastics and polymerization process.
CO1103.5	Experiment Recycled Waste Products and Reclaimed Materials in civil engineering.

**B. DETAILED SYLLABUS**

<b>Unit 1</b>	Aggregate Nature and properties -aggregate requirements- types and processing-aggregates for pavement base -aggregate for bituminous mixture -aggregate for Portland Cement Concrete -lightweight aggregate- tests on aggregate-specification
<b>Unit 2</b>	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.
<b>Unit 3</b>	Cement /concrete based materials Cement-properties-PCC mix design and propertie- modified PCC- Mix Design-Behavior-Performance-Tests on Cement and Concrete mixes. High Performance Concrete-low shrinkage-increased strength.
<b>Unit 4</b>	Composites, Plastics and Geo-synthetics Plastics and polymerization process-properties-durability and chemical composition-Reinforced Polymer Composites-Geo-synthetics-Dry Powdered Polymers-Enzymes
<b>Unit 5</b>	Reclaimed / Recycled Waste Products Reclaimed Materials-waste products in civil engineering applications -effect of waste products on materials, structure and properties-self healing and smart materials- locally available materials.

**C. RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Author
1.	Alternative Materials in Road Construction	P. T. Sherwood, Thomas Telford Publication, London, 1997.
2.	Soil Mechanics for Road Engineers	RRL, DSIR, HMSO, London , 1995
3.	Designing with Geosynthetics	Koerner, R. M., Prentice Hall, Englewood Cliffs, New Jersey, U.S.A.
4.	Civil Engineering Materials	Shan Somayaji, second edition, Prentice Hall Inc., 2001

S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/105/105/105105107/">https://nptel.ac.in/courses/105/105/105105107/</a>
2.	<a href="https://nptel.ac.in/courses/105/106/105106053/">https://nptel.ac.in/courses/105/106/105106053/</a>
3.	<a href="https://nptel.ac.in/courses/105/102/105102088/">https://nptel.ac.in/courses/105/102/105102088/</a>

#### D. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1103.1	3	3	-	-	-	-	-	-	-	-	-	-
CO1103.2	2	2	2	-	-	-	-	-	-	-	-	-
CO1103.3	2	-	2	3	-	-	-	-	-	-	-	-
CO1103.4	2	-	2	-	-	2	-	-	-	-	-	-
CO1103.5	2	2	1	-	1	-	-	-	-	-	-	-

#### E. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1103.1	2	3	1	-	-
CO1103.2	3	3	-	-	-
CO1103.3	3	2	1	-	-
CO1103.4	2	-	1	-	-
CO1103.5	2	2	-	3	-

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development



**COURSE OVERVIEW AND OBJECTIVES**

This course deals with the analysis of traffic flow and its distribution on the road. The basic understanding of different models in this course makes the students able to understand the present and future characteristics of traffic. This course also gives the conclusive idea about the use of GPS in traffic system advancement.

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO1105.1	Compare relationship between traffic stream parameters.
CO1105.2	Analyze the macroscopic models, fluid flow analogies and bottleneck control approach.
CO1105.3	Design Microscopic model and service time distributions.
CO1105.4	Evaluate car following modal in traffic behavior analysis.
CO1105.5	Interpret the GPS in traffic engineering for advancement of intelligent traffic system.

**DETAILED SYLLABUS**

<b>Unit 1</b>	Traffic stream parameters - Fundamental diagram of volume-speed-density surface. Discrete and continuous probability distributions. Merging maneuvers - critical gaps and their distribution.
<b>Unit 2</b>	Macroscopic models - Heat flow and fluid flow analogies - Shock waves and bottleneck control approach.
<b>Unit 3</b>	Microscopic models - Application of queuing theory - regular, random and Erlang arrival and Service time distributions - Queue discipline - Waiting time in single channel queues and extension to multiple channels.
<b>Unit 4</b>	Linear and non-linear car following models - Determination of car following variables - Acceleration noise
<b>Unit 5</b>	Geographical Information System - Global Positioning System - Intelligent Transportation Systems - Area Traffic Control - Automatic Toll Collection - Smart Cards - Collision Detection System

**RECOMMENDED STUDY MATERIAL:**

S.	Title of the Book	Author
1.	Traffic Flow Theory and Control	Drew, D.R., McGraw Hill., 1978.
2.	Traffic Flow Theory - A Monograph	TRB, SR165, 1975.
3.	Principles of Geographical Information Systems	Burrough P.A. and Rachel A. McDonell, OxfordPublication, 2004
4.	Perspective on ITS	Sussman, J. M., Artech House

S. No	Important web links
1.	<a href="https://www.youtube.com/watch?v=3XaTwQIugJ4">https://www.youtube.com/watch?v=3XaTwQIugJ4</a>
2.	<a href="https://nptel.ac.in/courses/105/105/105105107/">https://nptel.ac.in/courses/105/105/105105107/</a>

#### D.CO's AND PO's MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1105.1	2	1	2	-	-	-	1	-	-	-	-	1
CO1105.2	2	1	2	-	1	-	-	-	-	-	-	2
CO1105.3	-	3	-	2	-	-	-	-	-	1	-	-
CO1105.4	1	1	-	2	1	-	-	-	-	1	-	-
CO1105.5	-	1	-	2	1	-	-	-	-	1	-	1

#### E.CO's AND PSO's MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1105.1	2	1	1	2	2
CO1105.2	2	1	1	2	1
CO1105.3	3	2	-	1	-
CO1105.4	1	1	3	1	-
CO1105.5	-	-	-	2	3

**Note:** On the basis of mapping of COs with POs, this course is related to Skill Development

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO1105.1	Demonstrate Project based on Management, Processes and project life cycle.
CO1105.2	Interpret Organizational Structures in project.
CO1105.3	Examine the payment to Contract-actors, Tendering, Restricted and open tenders.
CO1105.4	Evaluate PERT and critical path method using Project management software's.
CO1105.5	Interpret the project failures, audit, data collection and analysis.

**DETAILED SYLLABUS**

Unit 1	Introduction to Project & project Management: Basic Theory and Concepts, Project Management –Processes, Knowledge Areas & project life cycle. Conclusion of Unit
Unit 2	Introduction to Organizational Structures: different types of organizations, I.e. matrix, function & projected organizations, Influence of organization on projects, role & functions of construction project manager, Project management offices, supportive, controlling & directive PMO, Conclusion of Unit
Unit 3	Introduction to vendor evaluation, criteria for rating vendors, steps for vendor evaluation, Analytic Hierarchy Process (AHP) Project Contracts, types of contracts, types of payments to contractors Tendering, Restricted & open tenders, Negotiated tender & Competitive dialogue & Conclusion of Unit
Unit 4	Introduction to PERT & CPM, Determination of critical path Resource leveling & resource allocation techniques Project management software's. Conclusion of Unit
Unit 5	Common project failures and need for project audit phases of project Audit, Determination of success criteria and questionnaire development, data collection and analysis, report development & Project check-List

**RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Author
1.	Project Management - A systems approach to Planning, Scheduling and Controlling	Herold Kerzner, CBS Publishers and Distributors
2.	Fundamentals of Construction Management and Organizations	K.Waker A Teraih and Jose M.Grevam
3.	Construction Cost Engineering Handbook - Marcel	Anghel Patterson

S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/110/104/110104073/">https://nptel.ac.in/courses/110/104/110104073/</a>
2.	<a href="https://nptel.ac.in/courses/110/107/110107081/">https://nptel.ac.in/courses/110/107/110107081/</a>

#### D. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1105.1	2	1	2	-	1	-	1	-	-	-	-	1
CO1105.2	1	1	2	-	1	-	-	-	-	-	-	-
CO1105.3	1	-	3	-	1	-	-	-	-	-	-	1
CO1105.4	2	-	3	-	1	-	-	-	-	-	-	-
CO1105.5	2	1	2	-	1	-	-	-	-	-	-	1

#### E. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1105.1	2	-	2	2	-
CO1105.2	2	-	1	3	1
CO1105.3	1	-	3	1	-
CO1105.4	2	-	3	-	-
CO1105.5	2	-	1	3	1

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

**COURSE OVERVIEW AND OBJECTIVES**

This course deals with the advancement of the transportation system with the application of ITS. The students learn in this course use of telecommunication and other sensors for achieving the objectives of the ITS. The data collection process and various functional areas of the ITS is to be discussed in this course.

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO1106.1	Analyze ITS, AVL, AVI and GIS.
CO1106.2	Demonstrate Traffic Management Centre (TMC), Vehicle, Road side communication and Vehicle Positioning System.
CO1106.3.	Interpret Advanced Traffic Management, Advanced Traveler Information, Commercial Vehicle Operations, Advanced Vehicle Control, Public and Rural Transportation Systems.
CO1106.4	Examine the management of Travel, Traffic, Public Transportation and safety.
CO1106.5	Relate Automated Highway Systems with ITS Programs.

**A. DETAILED SYLLABUS**

<b>Unit 1</b>	Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.
<b>Unit 2</b>	Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centers (TMC). Vehicle – Road side communication – Vehicle Positioning System
<b>Unit 3</b>	ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).
<b>Unit 4</b>	ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management
<b>Unit 5</b>	Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed Countries, ITS in developing countries.

**B. RECOMMENDED STUDY MATERIAL:**

S.	Title of	Author
1.	Recommendations for World Road Association (PIARC)	Kan Paul Chen, John Miles, ITS Hand Book 2000

S. No	Important web links

1.	<a href="https://nptel.ac.in/courses/103/105/103105128/">https://nptel.ac.in/courses/103/105/103105128/</a>
2.	<a href="https://nptel.ac.in/courses/105/106/105106058/">https://nptel.ac.in/courses/105/106/105106058/</a>

#### D. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1106.1	2	1	2	-	1	-	1	-	-	-	-	1
CO1106.2	1	1	2	-	1	-	-	-	-	-	-	-
CO1106.3	1	-	3	-	1	-	-	-	-	-	-	1
CO1106.4	2	-	3	-	1	-	-	-	-	-	-	-
CO1106.5	2	1	2	-	1	-	-	-	-	-	-	1

#### E. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1106.1	2	-	2	2	-
CO1106.2	2	-	1	3	1
CO1106.3	1	-	3	1	-
CO1106.4	2	-	3	-	-
CO1106.5	2	-	1	3	1

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

**COURSE OUTCOME****After completion of this course, student will be able to:**

CO No.	Description
CO1201.1	To present themselves in an effective manner and know about their short-term and long-term goals.
CO1201.2	To works in a team by managing time properly and focus on personal grooming, etiquettes and body language.
CO1201.3	To demonstrate their abilities by improving skills of LSRW (Listening Speaking/Reading/Writing).
CO1201.4	To present different viewpoints or ways of thinking about a situation, expand their abilities to resolve situations and get experience within the given context.
CO1201.5	To enhance their employability skills by working on the presentation of Résumé and giving impactful performance during Group Discussion.

**DETAILED SYLLABUS**

1.	Self- Introduction & knowing your environment
2.	Goal Setting & Planning
3.	Etiquettes (Personal, Social, Professional & Corporate) etiquettes
4.	Personal Grooming and Body language
5.	Time Management & Team Work
6.	Negotiation and conflict management
7.	Oral Communication & Writing Skills: Extempore & Paper Presentations.
8.	Resume Writing
9.	Group Discussion
10.	Interview Skills

S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/109/107/109107121/">https://nptel.ac.in/courses/109/107/109107121/</a>
2.	<a href="https://nptel.ac.in/courses/109/104/109104107/">https://nptel.ac.in/courses/109/104/109104107/</a>

**A. DETAILED SYLLABUS**

Unit	Contents
	Students will be grouped in two to three, will have to decide final thesis area, download research papers from IEEE, ACM, Elsevier, Springer etc. Summarizing paper – Reading abstracts and finding ideas, conclusion, Advantages of Their approach, and the drawbacks of the papers. Generalize results from a research paper to related research problems. Comparing the approach - Identify weaknesses and strengths in recent research articles in the subject. Practice sessions on how to read, analyze and summarize research papers. Students in group will have to deliver seminar, prepare a report and a review paper based on analysis.



POORNIMA UNIVERSITY, JAIPUR									
Faculty of Engineering and Technology									
Name of Program:	M.Tech. in Transportation Engineering			Duration: 2 Years			Total Credits: 80		
Teaching Scheme for Batch 2023-25									
Semester-II									
Course Code	Name of Course	Teaching Scheme				Marks Distribution			Credits
		Lecture (L)	Tutorial (T)	Practical	SH	IE	ESE	Total	
<b>A. Major (Core Courses)</b>									
<b>A.1 Theory</b>									
MTECCV2101	Highway Traffic Analysis and Design	3	1	-		40	60	100	4
MTECCV2102	Highway Construction Practice	3	1	-		40	60	100	4
<b>A.2 Practical</b>									
MTECCV2201	Transportation Engineering Lab-II	-	-	2		60	40	100	1
<b>B. Minor Stream Courses/ Department Electives I and II</b>									
<b>B.1 Theory</b>									
MTEECV2101	Analysis of Transportation Systems	3	1	-	-	40	60	100	4
MTEECV2102	Transportation Planning			-	-	40	60	100	
MTEECV2103	Environmental Impact Assessment			-	-	40	60	100	
MTEECV2104	Transportation Network Analysis and Optimization	3	0	-	-	40	60	100	3
MTEECV2105	Transportation Project Evaluation and Decision Making			-	-	40	60	100	
MTEECV2106	Intelligent Transportation Systems			-	-	40	60	100	
<b>B.2 Practical</b>									
	-	-	-	-	-	-	-	-	-
<b>C Multidisciplinary Courses</b>									
MULEBX2109	Engineering Economics	3	-	-	-	40	60	100	3
<b>D Ability Enhancement Courses (AEC)</b>									
MULCHM2201	Soft Skills - II	-	-	2		60	40	100	1
<b>E Skill Enhancement Courses (SEC)</b>									
MULCSE2201	Skill Enhancement Technical Course-II	-	-	2		60	40	100	1
<b>F Value Added Courses (VAC)</b>									
	-	-	-	-	-	-	-	-	-
<b>G Summer Internship / Research Project / Dissertation</b>									
MTECCV2401	Seminar-II	-	-	2	-	60	40	100	1
<b>Total</b>		15	3	8					<b>22</b>
<b>Total Teaching Hours</b>		<b>26</b>							<b>22</b>

**M. Tech.**  
**TRANSPORTATION**  
**ENGINEERING**  
**Syllabus-Second Semester**

**Code: MTECCV2101**

**Highway Traffic Analysis and Design**

**4 Credits [LTP: 3-1-0]**

**COURSE OVERVIEW AND OBJECTIVES**

This course stands with objectives of learning analysis and design process of highways. In this course the study of traffic volume computation, pavement geometric design, design of road intersections and the road safety practice is to be carried out.

**COURSE OUTCOME**

**After completion of this course, student will be able to:**

CO No.	Description
CO2101.1	Analyze the elements of traffic engineering for pavement design.
CO2101.2	Demonstrate surveying techniques of traffic for design of various components of transportation.
CO2101.3	Design the process of facilities of road transportation.
CO2101.4	Design of intersections, rotaries, signs and signal of road facilities.
CO2101.5	Evaluate the measures for road safety by pavement analysis and design.

**DETAILED SYLLABUS**

<b>Unit 1</b>	Elements of Traffic Engineering - road user, vehicle and road way and driver characteristics. – Design speed, volume. Passenger Car Units - Static and Dynamic- Highway capacity and level of service - capacity of urban and rural
<b>Unit 2</b>	Traffic volume studies, origin destination studies, speed studies, travel time and delay studies, Parking studies, Accident studies. - Road user facilities – Parking facilities - Cycle tracks - Pedestrian facilities.
<b>Unit 3</b>	Elements of design - Alignment - Cross sectional elements - Stopping and passing sight distance. Horizontal curves - Vertical curves. Design problems. Traffic regulation and control - Signs and Markings - Traffic System Management.
<b>Unit 4</b>	Design of intersections – At-grade intersections- Principles of design – Channelization - Design of rotaries - Traffic signals - pre-timed and traffic actuated. Design of signal setting - phase diagrams, timing diagram – Signal co- ordination – Area traffic Control System. Grade separated interchanges - Geometric elements for divided and access-controlled highways and expressways
<b>Unit 5</b>	Traffic Safety – Principles and Practices – Safety along links - Safety at intersections. Road Safety Audi– Countermeasures, evaluation of effectiveness of counter-measures– Road safety programmes

**RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Author
1	ITE Hand Book, Highway Engineering	McGraw – Hill
2	A Policy on Geometric Design of Highway and Streets	AASHTO
3	Traffic Engineering – Theory & Practice	Pignataro, L.J., John Wiley, 1985

4	Highway Traffic Analysis and Design	R. J. Salter and N. B. Hounsel, , Macmillan Press Ltd, 1996.
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S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/105/105/105105107/">https://nptel.ac.in/courses/105/105/105105107/</a>
2.	<a href="https://www.youtube.com/watch?v=pMcOgiWIGDU">https://www.youtube.com/watch?v=pMcOgiWIGDU</a>

#### D. COs and Pos Mapping

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2101.1	1	2	2	-	1	-	1	-	-	-	-	-
CO2101.2	1	1	2	-	1	-	-	-	1	-	-	1
CO2101.3	3	-	-	2	1	-	-	-	-	1	-	-
CO2101.4	-	3	-	1	-	-	-	-	-	-	-	-
CO2101.5	1	-	1	3	-	-	-	-	-	-	-	1

#### E. COs and Pos Mapping

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO2101.1	2	-	3	-	-
CO2101.2	1	3	-	1	1
CO2101.3	2	-	3	-	-
CO2101.4	2	3	-	1	-
CO2101.5	-	-	-	2	3

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

**COURSE OVERVIEW AND OBJECTIVES**

This subject is very practical for the learners. In this subject student have to practice the IRC and IS code for the construction of highways and to select the suitable materials for pavements.

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO2102.1	Evaluate construction of embankment cutting in Soil and hard rock by using Water Bound Macadam, Wet Mix Macadam, Cement treated bases, Dry Lean Concrete (DLC) and highway drainage system design.
CO2102.2	Interpret Bituminous Constructions wearing, deck slabs, Construction techniques and Quality Control.
CO2102.3	Design concrete road and construction joints.
CO2102.4	Analyze Construction of Continuously reinforced, Pre-stressed and Steel Fiber Reinforced Pavements.
CO2102.5	Design hill roads based on Slopes, Landslides, Causes, drainage and Control measures.

**DETAILED SYLLABUS**

<b>Unit 1</b>	Embankment Construction: Formation cutting in Soil and hard rock, Preparation of Subgrade, Ground improvement, Retaining and Breast walls on hill roads, Granular and Stabilized, Sub – bases / bases, Water Bound Macadam (WBM), Wet Mix Macadam (WMM), Cement treated bases, Dry Lean Concrete (DLC), highway drainage system design
<b>Unit 2</b>	Bituminous Constructions: Types of Bituminous Constructions, Interface Treatments, Bituminous Surfacing and wearing Courses for roads and bridge deck slabs, Selection of wearing Course under different Climatic and Traffic conditions, IRC specifications, Construction techniques and Quality Control.
<b>Unit 3</b>	Concrete road construction: Test on Concrete mixes, Construction equipment, Method of construction of joints in concrete pavements, Quality Control in Construction of Concrete pavements,
<b>Unit 4</b>	Construction of Continuously reinforced, Prestressed, Steel Fiber Reinforced (SFRC) Pavements, IRC, MORT&H, ACI Specifications, AASHTO Specifications, Recycled pavements, non – Conventional Pavements, Overlay Construction.
<b>Unit 5</b>	Hill Roads Construction: Stability of Slopes, Landslides – Causes and Control measures, Construction of Bituminous and Cement Concrete roads at high altitudes, Hill road drainage, Construction and maintenance problems and remedial measures

**RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Author
1	Principles and Practices of Highway Engineering	L. R. Kadiyal and B. N. Lal
2	MORT&H, IRC	Krishna Raju N. (1989), CBS Publishers and distributors, New Delhi.

S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/105/102/105102088/">https://nptel.ac.in/courses/105/102/105102088/</a>
2.	<a href="https://nptel.ac.in/courses/105/101/105101143/">https://nptel.ac.in/courses/105/101/105101143/</a>

#### D. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2102.1	1	2	-	-	3	-	-	-	-	-	1	-
CO2102.2	1	1	-	-	3	-	-	-	-	-	1	-
CO2102.3	1	-	-	-	3	-	-	-	1	-	1	-
CO2102.4	1	1	-	-	3	-	-	-	-	-	1	-
CO2102.5	1	1	-	-	3	-	-	-	1	-	1	-

#### E. COs AND POs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO2102.1	1	3	-	2	-
CO2102.2	1	3	-	2	-
CO2102.3	1	3	-	2	-
CO2102.4	1	3	-	2	-
CO2102.5	1	3	-	2	-

**Note:** On the basis of mapping of COs with POs, this course is related to Entrepreneur

**Code: MTECCV2201**

**Transportation Engineering Lab-II**

**1 Credits [LTP: 0-0-2]**

**A. DETAILED SYLLABUS**

**List of Experiments**

Design as per syllabus of theory

S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/105/107/105107123/">https://nptel.ac.in/courses/105/107/105107123/</a>

## B. Department Elective Courses

<b>Code: MTEECV2101</b>	<b>Analysis of Transportation Systems</b>	<b>4 Credits [LTP: 3-1-0]</b>
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### COURSE OVERVIEW AND OBJECTIVES

This course deals with the analysis process which is used in data collection for design of various facilities of roads. In this course study of the traffic survey, traffic assignment, role measurement of public transportation and traffic control is to be carried out.

### COURSE OUTCOME

**After completion of this course, student will be able to:**

CO No.	Description
CO2101.1	Analyze the components and the factors governing the transportation system design.
CO2101.2	Interpret the basics of traffic survey and its assignment.
CO2101.3	Demonstrate the methods of dynamic traffic assignment.
CO2101.4	Compare all the components of public transport systems.
CO2101.5	Evaluate models for traffic control.

### A. DETAILED SYLLABUS

<b>Unit 1</b>	Introduction: transportation systems, transportation innovations, social and economic impacts of portation, Decision makers and their options, demand modeling and predictions, Modeling portation systems. Analysis of network flows: Shortest- Path Problems, Maximum-flow Problems, imum-cost network flow problems, Minimum Spanning tree problem, The network simplex method
<b>Unit 2</b>	Static Traffic Assignment: All-or-nothing (AON) assignment, Link cost function, Equilibrium ciples: User Equilibrium (UE) and System Optimal (SO), Formulations of SO and UE, Uniqueness of and SO formulations, multi-mode traffic assignment, Variable Demand assignment, Stochastic Traffic Assignment, Solution of traffic assignment problems.
<b>Unit 3</b>	Dynamic Traffic Assignment (DTA): Introduction, Point queue model, Cell Transmission Model, le link model, Dynamic user equilibrium (DUE), Analytical Models of DUE, Solution of DUE ulations, Simulation based DUE.
<b>Unit 4</b>	Public Transportation Systems: Transit Assignment, Transit route network planning, performance monitoring, vehicle and crew scheduling. Decision Making in sortation Networks: Congestion pricing ,network design problems, prioritizing investment
<b>Unit 5</b>	Optional Topics: Integrated land-use and transport modelling, Activity based travel And modelling, Entropy in the analysis of utility maximizing systems, Entropy maximization and gravities

**B. RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Au
1	Transportation Systems Analysis: Models and Application, Springer, 2009	Cascetta, E.
2	Urban Transportation Networks: Equilibrium Analysis with Mathematical Programming Method. Prentice-Hall, EnglewoodCliffs, 1985	Sheffi, Y.
3	Modeling Dynamic Transportation Network –An Intelligent Transportation System Oriented Approach, Springer-Verlag, Heidelberg, 1996	Ran, B., and Boyce, D. E.
4	Applied Systems Analysis: Engineering Planning and Technology Management, McGraw Hill, 1990	de Neufville, R.

S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/105/106/105106188/">https://nptel.ac.in/courses/105/106/105106188/</a>
2.	<a href="https://nptel.ac.in/courses/105/107/105107123/">https://nptel.ac.in/courses/105/107/105107123/</a>

**D. COs and Pos Mapping**

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2101.1	1	2	2	-	1	-	1	-	-	-	-	-
CO2101.2	1	1	2	-	1	-	-	-	1	-	-	1
CO2101.3	3	-	-	2	1	-	-	-	-	1	-	-
CO2101.4	-	3	-	1	-	-	-	-	-	-	-	-
CO2101.5	1	-	1	3	-	-	-	-	-	-	-	1

**E. COs and PSO Mapping**

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO2101.1	2	-	3	-	-
CO2101.2	1	3	-	1	1
CO2101.3	2	-	3	-	-
CO2101.4	2	3	-	1	-
CO2101.5	-	-	-	2	3

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development



**COURSE OVERVIEW AND OBJECTIVES**

This course deals with the planning of road network and transportation facilities. In this subject the students learn the different models for preparing plan for maximum road capacity.

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO2102.1	Define the objectives of urban planning and management of travel demand.
CO2102.2	Demonstrate trip generation and trip distribution modal.
CO2102.3	Analyze modal split modal and it's use in traffic engineering.
CO2102.4	Interpret the land use modal of transportation planning.
CO2102.5	Evaluate alternative plan and monitoring projects.

**A. DETAILED SYLLABUS**

<b>Unit 1</b>	Urban morphology - Urbanization and travel demand – Urban activity systems and travel patterns – Systems approach – Trip based and Activity based approach - Urban Transportation Planning – Goals, Objectives and Constraints - Inventory, Model building, Forecasting and Evaluation - Study area delineation – Zoning - UTP survey
<b>Unit 2</b>	Trip generation models – Trip classification - productions and attractions – Trip rate analysis - Multiple regression models - Category analysis - Trip distribution models – Growth factor models, Gravity model and Opportunity modes.
<b>Unit 3</b>	Modal split models – Mode choice behavior – Trip end and trip interchange models - Probabilistic models - Utility functions - Logit models - Two stage model. Traffic assignment – Transportation networks – Minimum Path Algorithms - Assignment methods – All or Nothing assignment, Capacity restrained assignment and Multi path assignment - Route-choice behavior.
<b>Unit 4</b>	Land use transportation models – Urban forms and structures - Location models - Accessibility– Land use models - Lowry derivative models - Quick response techniques - Non-Transport solutions for transport problems
<b>Unit 5</b>	Preparation of alternative plans-Evaluation techniques - Plan implementation- Monitoring - Financing of Project – urban development planning policy - Case studies.

**B. RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Author
1.	Principles of Urban Transport Systems Planning, Scripta, McGraw-	Hutchinson, B.G.
2.	Transportation Engineering - An Introduction, Prentice Hall, NJ, 2007	Khisty C.J.
3.	Transportation Engineering & Planning, PHI, New Delhi, 2002	Papacostas C.S. and Prevedouros, P.D.

S. No	Important web links
1.	<a href="http://www.digimat.in/nptel/courses/video/105106058/L13.html">http://www.digimat.in/nptel/courses/video/105106058/L13.html</a>
2.	<a href="https://www.youtube.com/watch?v=YAEyLOCU-8I">https://www.youtube.com/watch?v=YAEyLOCU-8I</a>

#### D. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2102.1	1	2	-	-	3	-	-	-	-	-	1	-
CO2102.2	1	1	-	-	3	-	-	-	-	-	1	-
CO2102.3	1	-	-	-	3	-	-	-	1	-	1	-
CO2102.4	1	1	-	-	3	-	-	-	-	-	1	-
CO2102.5	1	1	-	-	3	-	-	-	1	-	1	-

#### E. COs AND POs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO2102.1	1	3	-	2	-
CO2102.2	1	3	-	2	-
CO2102.3	1	3	-	2	-
CO2102.4	1	3	-	2	-
CO2102.5	1	3	-	2	-

**Note:** On the basis of mapping of COs with POs, this course is related to Entrepreneur

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO2103.1	Define the environmental impact assessment for EIA, TOR, and IEE.
CO2103.2	Analyze Tools for assess environmental impact based on Checklist, Network, Matrices, Overlays, Mathematical Modeling, Adhoc committee.
CO2103.3	Interpret Air, Noise and Environmental Impact Assessment for land use and water quantity.
CO2103.4	Demonstrate plankton, nekton, benthos and importance coastal habitat for biological aquatic ecology.
CO2103.5	Evaluate environmental impact assessment for quality of life, socio-economic Mitigation and Monitoring process.

**A. DETAILED SYLLABUS**

<b>Unit 1</b>	Definition and history of environmental impact assessment, related law necessary for EIA Process for EIA, TOR, IEE.
<b>Unit 2</b>	Components of EIA Reports Tools for assess environmental impact: Checklist, Network, Matrices, Overlays, Mathematical Modeling, Adhoc committee
<b>Unit 3</b>	Environmental Impact Assessment for air and noise, Environmental Impact Assessment for soil and land use, Environmental impact Assessment for water quantity.
<b>Unit 4</b>	Assessment for biological: terrestrial ecology forest and wildlife Environmental Impact Assessment for biological aquatic ecology: plankton, nekton, benthos and importance coastal Habitat.
<b>Unit 5</b>	Environmental Impact Assessment for human use Environmental Impact, Assessment for quality of life, socio-economic Mitigation and Monitoring process for environmental impact assessment

**B. RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Author
1.	Environmental Impact Assessment. McGraw-Hill, Inc. Printed in the	Canter L.W.1977.
2.	Environmental Impact Statements. John Wiley &	Eccleston, H.C.2000.

S. No	Important web links
1.	<a href="https://www.youtube.com/watch?v=LwtGqpMTEnk">https://www.youtube.com/watch?v=LwtGqpMTEnk</a>
2.	<a href="https://www.youtube.com/watch?v=-zqAjBpG0Jw">https://www.youtube.com/watch?v=-zqAjBpG0Jw</a>

#### D.COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2103.1	2	1	2	-	1	-	-	-	-	-	-	1
CO2103.2	1	2	2	-	1	-	1	-	-	-	-	-
CO2103.3	1	1	2	-	1	-	-	-	1	-	-	1
CO2103.4	1	-	2	-	2	-	-	1	-	-	-	1
CO2103.5	1	1	2	-	1	-	-	-	1	-	-	1

#### E.COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO2103.1	-	2	3	-	1
CO2103.2	3	1	-	2	-
CO2103.3	1	3	-	1	1
CO2103.4	2	-	1	-	3
CO2103.5	3	2	1	-	1

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO2104.1	Analyze the Network flows, graphs, paths, trees, cycles loops, walk, network and basic network transformations.
CO2104.2	Interpret the Transportation Costs, Vehicle Operating Costs and Value of Travel Time Savings.
CO2104.3	Evaluate Algorithms using Shortest Path, Dijkstra and Dial methods.
CO2104.4	Analyze Minimum cost of network assignment as per principles, optimization and Frank-Wolfe algorithm.
CO2104.5	Demonstrate the TRIPS, SATURN, EMME/2, CUBE software's.

**A. DETAILED SYLLABUS**

<b>Unit 1</b>	Network flows Applications, definitions, graphs, paths, trees, cycles loops, walk, network representation (adjacency list and matrices) and basic network transformations; Network algorithms; Complexity, Search Algorithms, Strategies for designing polynomial algorithms.
<b>Unit 2</b>	Shortest Path Algorithms Label setting, Dijkstra's and Dial's algorithms, Optimality conditions, label correcting algorithms and optimality conditions, detecting negative cycles, all-pair shortest path algorithms; pre-flow push polynomial time algorithms, capacity scaling techniques
<b>Unit 3</b>	Minimum cost network assignment optimality conditions, cycle-canceling algorithm, Successive shortest path algorithm, other polynomial time variants; Network equilibrium analysis; principles and optimization formulations, Frank-Wolfe algorithm; Special cases and variants
<b>Unit 4</b>	Applications of min-cost, max-flow, and shortest path algorithms to transportation and infrastructure networks transportation networks, airline, freight, facility location, logistics, network design, project scheduling, reliability of distribution systems, telecommunication/power networks
<b>Unit 5</b>	Computer Software Principles of TRIPS, SATURN, EMME/2, CUBE; Demo Versions, Case studies

**B. RECOMMENDED STUDY MATERIAL:**

S.	Title of the	Author
1	Network Flows Theory, Algorithms and Application, PrenticeHall, New Jersey, 1993.	Ahuja, R., Magnanti, T.L., and Orlin, J.B.
2	Transportation Networks, Elsevier Science	Bell, M.G.

S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/111/105/111105039/">https://nptel.ac.in/courses/111/105/111105039/</a>
2.	<a href="https://nptel.ac.in/courses/106/105/106105154/">https://nptel.ac.in/courses/106/105/106105154/</a>

### COs AND POs MAPPING

COs and LOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2104.1	3	2	-	1	-	-	-	-	-	-	-	1
CO2104.2	3	1	-	1	-	-	-	-	-	-	-	1
CO2104.3	3	2	-	1	-	-	-	-	-	-	-	1
CO2104.4	3	1	2	1	-	-	-	-	-	-	-	1
CO2104.5	3	-	-	1	1	-	-	-	-	-	-	1

### COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO2104.1	3	-	-	2	-
CO2104.2	3	-	-	2	-
CO2104.3	3	-	-	2	-
CO2104.4	3	-	-	2	1
CO2104.5	3	1	-	-	1

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO2105.1	Analyze the Transportation Decision Making and Estimating Transportation Demand and Supply.
CO2105.2	Interpret the Transportation Costs, Vehicle Operating Costs and Value of Travel Time Savings.
CO2105.3	Demonstrate Accidents Costs based on safety impact evaluation, issues connected and estimating crash reduction factors.
CO2105.4	Analyze Economic Evaluation of Transportation Projects.
CO2105.5	Evaluate the Transportation Projects and Programs, Case study and Financial Analysis of Transportation Projects.

**A. DETAILED SYLLABUS**

<b>Unit 1</b>	Introductory Concepts in Transportation Decision Making: Overall transportation project development, budgeting, financial planning, the process of transportation project development, models associated with transportation impact evaluation, procedural framework for transportation systems evaluation. Estimating Transportation Demand and Supply: Demand- supply equilibration, dynamics of transportation demand and supply, elasticity of travel demand and supply, classification of elasticity, consumer surplus and latent demand
<b>Unit 2</b>	Transportation Costs: Classification of transportation costs, transportation agency costs, transportation user costs, general structure and behavior of cost functions and road pricing. Vehicle Operating Costs: Road user cost study in India, components of VOC, factors affecting VOC, fuel consumption relationships, procedural framework for assessing VOC impacts. Value of Travel Time Savings: Categorizations of travel time, framework for assessing travel time impacts, economic concept of evaluation of travel time savings, issues relating to travel time value estimation, methodology for monetary evaluation of passengers travel time, review of work in India on passengers travel time.
<b>Unit 3</b>	Accidents Costs: Relevance of accident costing for a developing country, procedural framework for safety impact evaluation, review of alternative methodologies for accident costing, certain issues connected with accident costing, methods for estimating crash reduction factors, before and after case studies.
<b>Unit 4</b>	Economic Evaluation of Transportation Projects: Economic significance of transport, performance measures in transportation evaluation, costs and benefits of transport projects, basic principles of economic evaluation, elements of engineering economics, methods of economic evaluation, benefit-cost ratio method, first year rate of return, net present value method, internal rate of return method, comparison of the various methods of economic evaluation, life cycle cost analysis, case studies, software packages for economic efficiency analysis.(HDM-4).
<b>Unit 5</b>	Evaluation of Transportation Projects and Programs using Multiple Criteria: Basic concepts, Single vs. multiple criteria, Evaluation, decision-making, and optimization, Steps in multi-criteria decision-making, Case study: evaluation of metro rail projects using multi-criteria. Financial Analysis of Transportation Projects: Financial analysis of high way project case study, PPP based transport project case study.

**B. RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Author
1.	Transportation Economics, Blackwell, 2001	McCarthy, P.
2.	Essays in Transportation economics and Policy, Brookings Institution Press, 1999	Meyer John Robert Meyer, JosA. Gmez-Ibez, William B. Tye, Clifford

3.	Principles of transportation economics, Addison-Wesley,	Kenneth Duncan Boyer
4.	Transportation Decision Making: Principles of Project	Kumares C. Sinha, Samuel Labi

S. No	Important web links
1.	<a href="https://nptel.ac.in/courses/112/107/112107238/">https://nptel.ac.in/courses/112/107/112107238/</a>

#### D.CO and POs Mapping

COs and LOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2105.1	3	2	-	1	-	-	-	-	-	-	-	1
CO2105.2	3	1	-	1	-	-	-	-	-	-	-	1
CO2105.3	3	2	-	1	-	-	-	-	-	-	-	1
CO2105.4	3	1	2	1	-	-	-	-	-	-	-	1
CO2105.5	3	-	-	1	1	-	-	-	-	-	-	1

#### E.CO and PSO Mapping

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO2105.1	3	-	-	2	-
CO2105.2	3	-	-	2	-
CO2105.3	3	-	-	2	-
CO2105.4	3	-	-	2	1
CO2105.5	3	1	-	-	1

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development



**COURSE OVERVIEW AND OBJECTIVES**

The objective of this course is to provide basic ideas about the intelligent transportation systems and to advance the transportation facilities.

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO2106.1	Compare between the historical background and features of intelligent transportation systems.
CO2106.2	Interpret the telecommunication systems in advancement of ITS.
CO2106.3	Analyze functional area of ITS and it's effects.
CO2106.4	Demonstrate the usability of ITS in road safety.
CO2106.5	Evaluate the automated highway systems and it's implementation in developed or in developing countries.

**A. DETAILED SYLLABUS**

<b>Unit 1</b>	Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques, Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.
<b>Unit 2</b>	Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centers (TMC). Vehicle – Road side communication – Vehicle Positioning System
<b>Unit 3</b>	ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).
<b>Unit 4</b>	ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.
<b>Unit 5</b>	Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.

**B. RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Author
1.	ITS Hand Book 2000 Recommendations for World Road Association (PIARC)	Kan Paul Chen, John Miles
2.	Perspective on ITS, Artech House Publishers, 2005.	Sussman, J. M.
3	ITS Architecture Documentation, US Department of Transportation, 2007	

S. No	Important web links
1.	<a href="https://www.youtube.com/watch?v=suTYujyKiwA">https://www.youtube.com/watch?v=suTYujyKiwA</a>
2.	<a href="https://www.youtube.com/watch?v=Nvf9vtazgX8">https://www.youtube.com/watch?v=Nvf9vtazgX8</a>

#### A. COs AND POs MAPPING

COs and LOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2106.1	3	2	-	1	-	-	-	-	-	-	-	1
CO2106.2	3	1	-	1	-	-	-	-	-	-	-	1
CO2106.3	3	2	-	1	-	-	-	-	-	-	-	1
CO2106.4	3	1	2	1	-	-	-	-	-	-	-	1
CO2106.5	3	-	-	1	1	-	-	-	-	-	-	1

#### B. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO2106.1	3	-	-	2	-
CO2106.2	3	-	-	2	-
CO2106.3	3	-	-	2	-
CO2106.4	3	-	-	2	1
CO2106.5	3	1	-	-	1

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

<b>Code: MULEBX2109</b>	<b>Engineering Economics</b>	<b>3 Credits [LTP:3-0-0]</b>
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**COURSE OVERVIEW AND OBJECTIVES:**

This course Acquire knowledge of economics to facilitate the process of economic decision making.  
 Acquire knowledge on basic financial management aspects.  
 Develop the skills to analyze financial statements.

**COURSE OUTCOME**

The student would be able

CO1101.1. Evaluate the economic theories, cost concepts and pricing policies.

CO1101.2 Understand the market structures and integration concepts

CO1101.3 Understand the measures of national income, the functions of banks and concepts of globalization

CO1101.4 Apply the concepts of financial management for project appraisal

CO1101.5 Understand accounting systems and analyze financial statements using ratio analysis

<b>A.</b>	<b>Outline of the Course</b>	
<b>Unit No.</b>	<b>Title of the unit</b>	<b>Time required for the Unit (Hours)</b>
1	Economics, Cost and Pricing Concepts	9
2	Concepts on Firms and Manufacturing Practices.	9
3	National Income, Money and Banking, Economic Environment	9
4	Concepts of Financial Management	9
5	Accounting System, Statement and Financial Analysis	9

<b>B.</b>	<b>DETAILED SYLLABUS</b>
1	<b>Economics, Cost and Pricing Concepts</b> Economic theories – Demand analysis – Determinants of demand – Demand forecasting – Supply – Actual cost and opportunity cost – Incremental cost and sunk cost – Fixed and variable cost – Marginal costing – Total cost – Elements of cost – Cost curves – Breakeven point and breakeven chart – Limitations of breakeven chart – Interpretation of breakeven chart – Contribution – P/V-ratio, profit-volume ratio or relationship – Price fixation – Pricing policies – Pricing methods
	<b>Concepts on Firms and Manufacturing Practices.</b> Firm – Industry – Market – Market structure – Diversification – Vertical integration – Merger – Horizontal integration
3	<b>National Income, Money And Banking, Economic Environment</b> National income concepts – GNP – NNP – Methods of measuring national income – Inflation – Deflation – Kinds of money – Value of money – Functions of bank – Types of bank – Economic liberalization – Privatization – Globalization
	<b>Concepts of Financial Management</b> Financial management – Scope – Objectives – Time value of money – Methods of appraising project profitability – Sources of finance – Working capital and management of working capital
5	<b>Accounting System, Statement And Financial Analysis</b> Accounting system – Systems of book-keeping – Journal – Ledger – Trail balance – Financial statements – Ratio analysis – Types of ratios – Significance – Limitations

<b>C. RECOMMENDED STUDY MATERIAL:</b>		
<b>S. No</b>	<b>Title of the Book</b>	<b>Author</b>
1	Financial Management   (Theory & Practice) TMH	Prasanna Chandra
2	Essentials of Managerial Finance	Weston & Brigham
3	Financial Management	Pandey, I. M
4	Fundamentals of Financial Management	James C. Van Horne
<b>Important Web links</b>		
1	<a href="https://www.youtube.com/watch?v=mX9nd0eQ-6g&amp;ab_channel=KrassimirPetrov">https://www.youtube.com/watch?v=mX9nd0eQ-6g&amp;ab_channel=KrassimirPetrov</a>	
2	<a href="https://www.youtube.com/watch?v=CCQwz_Gwo6o&amp;ab_channel=ITRoorkeeJuly2018">https://www.youtube.com/watch?v=CCQwz_Gwo6o&amp;ab_channel=ITRoorkeeJuly2018</a>	

<b>D</b>	<b>COs AND POs MAPPING</b>											
COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1101.1	1	1	-	3	-	1	-	-	-	-	1	-
CO1101.2	1	3	-	2	1	-	-	-	-	-	-	-
CO1101.3	1	-	-	3	1	-	-	-	-	-	1	-
CO1101.4	1	1	3	-	-	-	1	-	-	-	1	-
CO1101.5	1	1	3	-	1	1	-	-	-	-	-	1

<b>E</b>	<b>COs AND PSOs MAPPING</b>				
COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1101.1	1	2	3	1	-
CO1101.2	-	2	2	-	3
CO1101.3	1	1	-	3	2
CO1101.4	1	3	-	2	-
CO1101.5	1	3	-	2	-

**Note:** On the basis of mapping of COs with POs, this course is related to Employability/ Skill Development

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO2201.1	To present themselves in an effective manner and know about their short-term and long-term goals.
CO2201.2	To work in a team by managing time properly and focus on personal grooming, etiquettes and body language.
CO2201.3	Demonstrate their abilities by improving skills of LSRW (Listening/Speaking/Reading/Writing).
CO2201.4	To present different viewpoints or ways of thinking about a situation, expand their abilities to resolve situations and get experience within the given context.
CO2201.5	To enhance their employability skills by working on the presentation of Résumé and giving Impactful performance during Group Discussion.

**DETAILED SYLLABUS**

Unit	Unit Details
1	Self-Awareness, Self Esteem & Confidence
2	The Corporate Fit-Dressing and Grooming, Etiquette: Social etiquette, business etiquette – civic sense – social norms
3	Effective Management Skills Time & Stress Management: Act in time on commitment
4	Personal Grooming and Body language
5	Time Management & Conflict Management
6	Planning & Prioritizing, Emotional Intelligence: Managing Emotions
7	Oral Communication & Writing Skills: Extempore & Paper Presentations.
8	Selling Self/Job Hunting Writing resume / Curriculum vitae
9	Mock GD – Goal setting - Career planning
10	Mock interview or Interview skills

**A. COs AND POs MAPPING**

COs and LOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2201.1	3	2	-	1	-	-	-	-	-	-	-	1
CO2201.2	3	1	-	1	-	-	-	-	-	-	-	1
CO2201.3	3	2	-	1	-	-	-	-	-	-	-	1
CO2201.4	3	1	2	1	-	-	-	-	-	-	-	1
CO2201.5	3	-	-	1	1	-	-	-	-	-	-	1

**B. COs AND PSOs MAPPING**

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO2201.1	3	-	-	2	-
CO2201.2	3	-	-	2	-
CO2201.3	3	-	-	2	-
CO2201.4	3	-	-	2	1
CO2201.5	3	1	-	-	1

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

**A. DETAILED SYLLABUS**

Unit	Contents
	<p>Students grouped in two to three during Semester I, will now continue to download further the research papers in the area, analyze, allocate individually, the set of papers,</p> <p><b>Literature survey</b> Overview – What is literature survey, Functions of literature survey, maintaining a notebook, developing a Bibliography</p> <p>Methods of data collection – Observation, survey, contact methods, experimental, determining sample design Searching for publications – Publication databases, search engines and patent databases, Find some/all of the references for a given paper, including those that are not on the web</p> <p>Online tools – Google, Cite Seer, ACM Digital Library, IEEE, The on-line Computer Science bibliography, Survey papers, Finding material not on the web, Searching patents</p> <p><b>Publishing a paper</b> How to write scientific paper Structure of a conference and journal paper, how (and How Not) to write a Good Systems Paper: Abstract writing, chapter writing, discussion, conclusion, references, bibliography, and In-class discussion of technical writing examples, Poster papers, review papers, how to organize thesis Project report, How to write a research proposal? How research is funded? Research ethics – Legal issues, copyright, and plagiarism General advice about writing technical papers in English Tips for writing correct English Practice sessions on above will be conducted. Students will have to deliver seminar, prepare a report and a review paper based on analysis individually.</p>

POORNIMA UNIVERSITY, JAIPUR										
Faculty of Engineering and Technology										
Name of Program:	M.Tech. in Transportation Engineering		Duration: 2 Years			Total Credits: 80				
Teaching Scheme for Batch 2023-25										
Semester-III										
Course Code	Name of Course	Teaching Scheme				Marks Distribution			Credits	
		Lecture (L)	Tutorial (T)	Practical	SH	IE	ESE	Total		
<b>A. Major (Core Courses)</b>										
<b>A.1</b>	<b>Theory</b>									
MTECCV3101	Pavement Materials	3	1	-		40	60	100	4	
MTECCV3102	Research Methodology	3	1	-		40	60	100	4	
<b>A.2</b>	<b>Practical</b>									
MTECCV3201	Transportation Lab-III	-	-	2		60	40	100	1	
MTECCV3401	Review/Research Paper	-	-	2		60	40	100	1	
<b>B. Minor Stream Courses/ Department Electives/ Open Elective</b>										
<b>B.1</b>	<b>Theory</b>									
MULEEE3107	E-Commerce and Knowledge Management	3	1	-		40	60	100	3	
MULECV3108	Water and Environmental Pollution			-		40	60	100		
MULEME3109	IPR & Patents			-		40	60	100		
MULEEE3110	Robotics			-		40	60	100		
MULEEE3111	Digital India Implementation			-		40	60	100		
MULECV3112	Smart City Design			-		40	60	100		
MULEEE3113	Renewable Energy			-		40	60	100		
<b>B.2</b>	<b>Practical</b>									
<b>C. Multidisciplinary Courses</b>										
MSTEMC3121	MOOC Course - I	3	-	-	-	-	-	-	3	
<b>D. Ability Enhancement Courses (AEC)</b>										
<b>E. Skill Enhancement Courses (SEC)</b>										
-	-	-	-	-	-	-	-	-	-	
<b>F. Value Added Courses (VAC)</b>										
<b>G. Summer Internship / Research Project / Dissertation</b>										
MTECCV3402	Dissertation Part - I	-	-	12	-	60	40	100	6	
<b>Total</b>		12	3	16					<b>22</b>	
<b>Total Teaching Hours</b>		<b>31</b>								

**COURSE OVERVIEW AND OBJECTIVES**

The objectives of this course are to make the students familiar with the behaviour of the pavement materials and their interaction with the pavement. In this subject the learners have to collect all the characterization information of all the properties of the pavement to find the suitable pavement materials.

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO3101.1	Analyze the pavement materials and their interaction.
CO3101.2	Interpret the bitumen based secondary materials.
CO3101.3	Analyze the bituminous mixes properties with and without water effect.
CO3101.4	Design the mix of bituminous material.
CO3101.5	Examine cement concrete pavement materials.

**A. DETAILED SYLLABUS**

<b>Unit 1</b>	Subgrade soil characterization, interaction of soil with pavement, Origin of bitumen, physical and chemical properties and tests, constitution of bituminous road binders, interaction of bitumen with aggregate surface.
<b>Unit 2</b>	Bituminous Emulsions and Cutbacks Preparation, characteristics, uses and tests, modification of Bitumen- Manufacturing process of polymer modified bitumens (PMB), Performance of PMB, Recycling of asphalt pavement materials-HMA method, WMA method, centralized plant method, In-situ method.
<b>Unit 3</b>	Bituminous Mixes properties – Experimental methods; Deformation behavior of pavement, Resilient modulus, dynamic modulus and fatigue characteristics of bituminous mixes, Creep behavior, Surface energy concepts; Moisture and temperature sensitivity.
<b>Unit 4</b>	Weathering and Durability of Bituminous Materials and Mixes - Mix design concepts and approaches; Performance based Bitumen Specifications - Mix design methods- Marshall Mix design Method, Superpave Mix Design Method.
<b>Unit 5</b>	Cement Concrete for Pavement Construction Requirements, design of mix for CC pavement, joint filler and sealer materials, Reinforcing in CC pavement materials.

**B. RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Author
1.	RRL, DSIR, Bituminous Materials in Road Construction	HMSO Publication
2.	IS and IRC Publications	Kazimi, S.M.A., Tata McGraw Hill, 1976



S. No	Important web links
1.	<a href="https://www.youtube.com/watch?v=AnJNzIIV0dU">https://www.youtube.com/watch?v=AnJNzIIV0dU</a>
2.	<a href="https://www.youtube.com/watch?v=3oNa9Z94Hiw">https://www.youtube.com/watch?v=3oNa9Z94Hiw</a>

CO No.	Description
CO01102.1	Analyze the pavement and the pavement materials.
CO01102.2	Evaluate pavement design factors for deciding quantity of different components of pavement.
CO01102.3	Design flexible pavement by IRC,AASHTO and Mechanistic-Empirical Methods.
CO01102.4	Design rigid pavement and joints by IRC and AASHTO Methods.
CO01102.5	Interpret post performance of pavement.

### C. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO3101.1	2	3	-	-	1	-	-	-	-	-	-	-
CO3101.2	3	1	2	1	-	-	-	-	-	-	-	-
CO3101.3	1	-	3	2	1	-	-	-	-	-	-	-
CO3101.4	-	2	-	2	3	-	-	-	-	-	-	-
CO3101.5	2	-	2	3	-	-	-	-	-	-	-	-

### D. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO3101.1	3	-	2	-	2
CO3101.2	1	3	-	2	1
CO3101.3	2	1	3	1	-
CO3101.4	-	2	-	3	2
CO3101.5	2	-	2	-	3

**COURSE OVERVIEW AND OBJECTIVES**

To familiarize students with basic of research and the research process. To enable the students in conducting research work and formulating research synopsis and report. Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling

**COURSE OUTCOME**

After completion of this course, student will be able to:

CO No.	Description
CO3102.1	Distinguish a purpose statement, a research question or hypothesis, and a research objective.
CO3102.2	Define the meaning of a variable, and to be able to identify independent, dependent, and mediating variables
CO3102.3	Compare between categorical and continuous measures.
CO3102.4	Design a good quantitative purpose statement and good quantitative research questions and hypotheses
CO3102.5	Analyze the link between quantitative research questions and data collection and how research questions are operationalized in educational practice.

**A. OUTLINE OF COURSE**

Unit No.	Title of the unit	Time required for the Unit(Hours)
1	General	9
2.	Connections	10
3.	Towers	8
4.	Plastic Analysis	9
5.	Industrial Building	8

**B. DETAILED SYLLABUS**

Unit	Unit Details
1.	<b>Overview of Research Methodology</b> Introduction, Mathematical tools for analysis, Research problems in management, Types of research, Research Process, Data Collection & Presentation: Introduction, Primary data, Secondary data, Data Presentation
2.	<b>Review of Basic Statistical Measures &amp; Basic Multivariate Analysis</b> Introduction, Measures of Central Tendencies, Measures of Variation, Measures of Skewness. Basic Multivariate Analysis: Introduction, Correlation analysis, Forecasting, Linear regression & Timeseries
3.	<b>Design and Analysis of Experiments</b> Introduction, Analysis of Variance, Completely Randomized design, Randomized complete block design, Latin square design, Duncan's multiple Range Test, Functional design, second factorial Experiment, Expected Mean Square.
4.	<b>Algorithmic Research &amp; Simulation</b> Introduction, Algorithmic Research Problems, Types, Types of Solution Procedures, Steps of development, Steps of Algorithmic Research, Design of Experiments, Meta Heuristics for Combinational Problems. Simulation: Introduction, Need for simulation, Types, Simulation Languages, case study.
5.	<b>Report Writing and Presentation</b> Introduction, Types of report, Guidelines for review draft, Report format, Typing Instructions, Oral Presentations

#### A. RECOMMENDED STUDYMATERIAL:

S. No	Title of the Book	Author
1.	Research Methodology	R. Panneerselvam, PHI
2.	Research Methodology: Methods and Trends	Dr. C. R. Kothari
3.	Research Methodology: A Step by Step Guide for Beginners	Ranjit Kumar
Important Web Links		
<a href="https://libguides.wits.ac.za/c.php?g=693518&amp;p=4914913">https://libguides.wits.ac.za/c.php?g=693518&amp;p=4914913</a>		
<a href="https://www.scribbr.com/dissertation/methodology/">https://www.scribbr.com/dissertation/methodology/</a>		
<a href="https://www.open.edu/openlearn/money-management/understanding-different-research-perspectives/content-section-8">https://www.open.edu/openlearn/money-management/understanding-different-research-perspectives/content-section-8</a>		
<a href="https://www.researchgate.net/publication/270956555_CHAPTER_3_-_RESEARCH_METHODODOLOGY_Data_collection_method_and_Research_tools">https://www.researchgate.net/publication/270956555_CHAPTER_3_-_RESEARCH_METHODODOLOGY_Data_collection_method_and_Research_tools</a>		
<a href="https://www.youtube.com/watch?v=ze5bS-DNERk">https://www.youtube.com/watch?v=ze5bS-DNERk</a>		

#### D. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO3201.1	3	2	1	1	-	-	-	-	-	-	-	-
CO3201.2	-	2	3	-	2	-	-	-	-	-	-	-
CO3201.3	2	1	3	-	1	-	-	-	-	-	-	-
CO3201.4	2	3	-	2	-	-	-	-	-	-	-	-
CO3201.5	1	1	2	3	-	-	-	-	-	-	-	-

#### E. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO3201.1	3	2	1	-	1
CO3201.2	2	-	3	2	-
CO3201.3	1	-	3	1	2
CO3201.4	-	2	2	-	3
CO3201.5	2	1	-	3	1

Note: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

**Code: MTECCV3201****Transportation Lab-III****1 Credits [LTP: 0-0-2]****A. DETAILED SYLLABUS****List of Experiments**

Design as per syllabus of theory

Mapping of COs with POs, this course is related to Employability / Skill Development

**Code: MTECCV3401****Review/Research Paper****1 Credits [LTP: 0-0-2]****A. COURSE OVERVIEW AND OBJECTIVES**

To familiarize students with basic of research and the research process. To enable the students in conducting research work and formulating research synopsis and report. Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling

**COURSE OUTCOME**

The student will be able to:

CO02102.1 To be able to distinguish a purpose statement, a research question or hypothesis, and a research objective.

CO02102.2 To be able to define the meaning of a variable, and to be able to identify independent, dependent, and mediating variables

CO02102.3 To be able to distinguish between categorical and continuous measures

CO02102.4 To be able to design a good quantitative purpose statement and good quantitative research questions and hypotheses.

CO02102.5 To understand the link between quantitative research questions and data collection and how research questions are operationalized in educational practice.

**A. DETAILED SYLLABUS**

<b>Unit</b>	<b>Contents</b>
<b>1.</b>	<b>Foundations of Research</b>
	Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process
<b>2.</b>	<b>Problem Identification &amp; Formulation</b>
	Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis – Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance
<b>3.</b>	<b>Research Design</b>
	Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.
<b>4.</b>	<b>Qualitative and Quantitative</b>
	Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two

	approaches.
<b>5.</b>	<b>Data Analysis</b>
	Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.
<b>6.</b>	<b>Interpretation of Data and Paper Writing</b>
	Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.
<b>7.</b>	<b>Use of Encyclopedias, Research Guides, Handbook</b>
	Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline
<b>8.</b>	<b>Use of tools / techniques for Research</b>
	Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism

**B. RECOMMENDED STUDY MATERIAL:**

<b>S.No</b>	<b>Title of the Book</b>	<b>Author</b>
1.	Research Methodology	R. Panneerselvam, PHI
2.	Research Methodology: Methods and Trends	Dr. C. R. Kothari
3.	Research Methodology: A Step by Step Guide for Beginners	Ranjit Kumar

**COURSE OVERVIEW AND OBJECTIVES**

This course provides an introduction to information systems for business and management. It is designed to familiarize students with organizational and managerial foundations of systems, the technical foundation for understanding information systems

**COURSE OUTCOME**

The student would be able to

CO3107.1 Understand the basic concepts and technologies used in the field of management information systems;

CO3107.2 To impart the knowledge of the different types of management information systems;

CO3107.3 To Understand the processes of developing and implementing information systems;

CO3107.4 To aware of the ethical, social, and security issues of information systems;

CO3107.5 To familiarize students with organizational and managerial foundations of systems

**A. OUTLINE OF COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	<b>INTRODUCTION TO ELECTRONIC COMMERCE</b>	9
2.	<b>BUILDING OWN WEBSITE</b>	8
3.	<b>INTERNET AND EXTRANET</b>	9
4.	<b>ELECTRONIC DATA INTERCHANGE</b>	9
5.	<b>PLANNING FOR ELECTRONIC COMMERCE</b>	9

**B. Detailed Syllabus**

Unit	Unit Details
<b>Unit 1</b>	<b>INTRODUCTION TO ELECTRONIC COMMERCE</b> Introduction of Unit, what is E-Commerce (Introduction and Definition), Main activities E-Commerce, Goals of E-Commerce, Technical Components of E-commerce, Functions of E-commerce, Advantages and Disadvantages of E-commerce, Scope of E-commerce, Electronic commerce Applications, Electronic commerce and Electronic Business, Conclusion of Unit.
<b>Unit 2</b>	<b>BUILDING OWN WEBSITE</b> Introduction of Unit, Reasons for building own website, Benefits of website, Bandwidth requirements, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Banner Exchange, Shopping Bots, Conclusion of Unit
<b>Unit 3</b>	<b>INTERNET AND EXTRANET</b> Introduction of Unit, Definition of Internet, Advantages and Disadvantages of the Internet, Component of an Intranet Information technology structure, Development of a Intranet, Extranet and Intranet Difference, Role of Intranet in B2B Application, Conclusion of Unit.

<b>Unit 4</b>	<b>ELECTRONIC DATA INTERCHANGE</b> Introduction of Unit, Concepts of EDI and Limitation, Application of EDI, Disadvantages of EDI, EDI model, Conclusion of Unit.
<b>Unit 5</b>	<b>PLANNING FOR ELECTRONIC COMMERCE</b> Introduction of Unit, planning electronic commerce initiatives, linking objectives to business strategies, measuring cost objectives, comparing benefits to costs, strategies for developing electronic commerce web sites, Conclusion of Unit.

**A. RECOMMENDED STUDY MATERIAL:**

S. No	Title of the Book	Author
1.	E-Commerce	Greenstein &Feinman, Tata McGrew Hill
2.	Frontiers of Electronic Commerce	KalakotaWinston ,Pearson Education
Important Web Links:		
1.	<a href="https://www.kmslh.com/3-reasons-why-ecommerce-must-have-knowledge-management/">https://www.kmslh.com/3-reasons-why-ecommerce-must-have-knowledge-management/</a>	
2.	<a href="https://link.springer.com/chapter/10.1007/978-3-642-23993-9_31">https://link.springer.com/chapter/10.1007/978-3-642-23993-9_31</a>	
3.	<a href="https://ieeexplore.ieee.org/document/5279962">https://ieeexplore.ieee.org/document/5279962</a>	
4.	<a href="https://www.sciencedirect.com/science/article/pii/S0268401207001120">https://www.sciencedirect.com/science/article/pii/S0268401207001120</a>	
5.	<a href="https://www.slideshare.net/monoaziz/knowledge-management-1852596">https://www.slideshare.net/monoaziz/knowledge-management-1852596</a>	

**B. COs AND POs MAPPING**

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO3107.1	2	-	-	-	-	2	-	-	-	-	-	-
CO3107.2	2	-	-	-	-	2	2	-	-	-	-	-
CO3107.3	2	-	-	-	-	2	2	-	-	-	-	-
CO3107.4	2	-	-	-	-	1	-	-	-	-	-	-
CO3107.5	2	-	-	-	-	2	2	-	-	-	-	-

**C. COs AND PSOs MAPPING**

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO3107.1	2	-	-	-	2
CO3107.2	2	-	-	-	2
CO3107.3	2	-	1	-	2
CO3107.4	2	-	-	-	2
CO3107.5	1	-	-	-	-

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development / Entrepreneur

**COURSE OVERVIEW AND OBJECTIVES**

The aim of this course is to teach students about current environmental problems. From an environmental perspective, the student will learn how to develop an activity using various strategies to control, reduce and monitor all environmental problems that might arise as a result.

**COURSE OUTCOME**

The student would be able to

CO3108.1 To be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.

CO3108.2 To be able to analyse an industrial activity and identify the environmental problems.

CO3108.3 TO be able to plan strategies to control, reduce and monitor pollution.

CO3108.4 To be able to select the most appropriate technique to purify and/or control the emission of pollutants.

CO3108.5 To be able to apply the basis of an Environmental Management System (EMS) to an industrial activity.

**A.OUTLINE OF COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	<b>WATER AND WATER ANALYSIS</b>	9
2.	<b>WASTEWATER AND THEIR TREATMENT</b>	8
3.	<b>GLOBAL ATMOSPHERIC CHANGE</b>	9
4.	<b>AIR POLLUTION &amp; METEOROLOGY</b>	9
5.	<b>SOLID WASTE MANAGEMENT</b>	9

**DETAILED SYLLABUS**

<b>Unit 1</b>	<b>WATER AND WATER ANALYSIS</b> Water resources, Sources of water, characteristics of water, water pollutants, oxygen demanding wastes, surface water quality, ground water quality. Municipal water supply: Requisites of drinking water, Steps involved in treatment of water
<b>Unit 2</b>	<b>WASTEWATER AND THEIR TREATMENT</b> Wastewater Characteristics: Quality parameters: BOD, COD, TOC, Solids, DO, Nitrogen, Phosphorus, Standards of disposal into natural watercourses and on land, Indian standards. wastewater treatment systems, disposal scope
<b>Unit 3</b>	<b>GLOBAL ATMOSPHERIC CHANGE</b> The atmosphere of earth, greenhouse effect, radiative forcing of climate change, global warming potential, carbon cycle, carbon emissions from fossil fuels, regional impacts of temperature change, global initiatives.



<b>Unit 4</b>	<b>AIR POLLUTION &amp; METEOROLOGY</b> Atmospheric motion, Lapse rate, atmospheric stability, inversion, atmospheric dispersion, maximum mixing depth, Air quality standards, plume rise, emission controls. Air pollution control methods in industries. <b>NOISE POLLUTION:</b> Effect of noise on people, rating systems, community noise sources and criteria, traffic noise prediction, noise control
<b>Unit 5</b>	<b>SOLID WASTE MANAGEMENT</b> Integrated solid waste management, hazardous waste management, biomedical waste treatment technologies and disposal options, e-waste management, waste minimization for sustainability, waste management – Indian scenario.

**RECOMMENDED STUDYMATERIAL:**

S.No	Title of the Book	Author
1.	Environmental Engineering	Howard S Peavy, Donald RRowe, George Tchobanoglous
2.	Engineering: Treatment, and Reuse, 4th edition, Tata McGraw Hill, 2007.	Metcalf and Eddy Inc
3.	Manual for Water Treatment.	Ministry of Urban development, Govt of India
4.	Manual for Sewage Treatment	Ministry of Urban development, Govt of India
5.	Air Pollution	M N Rao
6.	Air Pollution Control Engineering	De Nevers
7	Solid Wastes: Engineering principles and Management issues	Tchobanoglous G.

**Important Web Links:**

- [https://www.google.co.in/search?biw=1366&bih=608&ei=Y4HLXvytHffYz7sPn9eB4AY&q=water+and+enviroment+polluation+nptel&oq=water+and+enviroment+polluation+nptel&gs\\_lcp=CgZwc3ktYWlQAzIKCCEQFhAKEB0QHjIKCCEQFhAKEB0QHjIKCCEQFhAKEB0QHjoECAAQRzoGCAAQFhAeOgcIIRAKEKABUlsYWP4mYMItaABwAXgAgAG8AogBuw2SAQcwLjEuNS4xmAEAoAEBqgEHZ3dzLXdpeg&sclient=psy-ab&ved=0ahUKEwi868D4y87pAhV37HMBHZ9rAGwQ4dUDCAw&uact=5](https://www.google.co.in/search?biw=1366&bih=608&ei=Y4HLXvytHffYz7sPn9eB4AY&q=water+and+enviroment+polluation+nptel&oq=water+and+enviroment+polluation+nptel&gs_lcp=CgZwc3ktYWlQAzIKCCEQFhAKEB0QHjIKCCEQFhAKEB0QHjIKCCEQFhAKEB0QHjoECAAQRzoGCAAQFhAeOgcIIRAKEKABUlsYWP4mYMItaABwAXgAgAG8AogBuw2SAQcwLjEuNS4xmAEAoAEBqgEHZ3dzLXdpeg&sclient=psy-ab&ved=0ahUKEwi868D4y87pAhV37HMBHZ9rAGwQ4dUDCAw&uact=5)
- <https://www.nrdc.org/stories/water-pollution-everything-you-need-know>
- <https://www.environmentalpollutioncenters.org/water/>
- <https://www.explainthatstuff.com/waterpollution.html>
- [https://wwf.panda.org/knowledge\\_hub/teacher\\_resources/webfieldtrips/water\\_pollution/](https://wwf.panda.org/knowledge_hub/teacher_resources/webfieldtrips/water_pollution/)

### COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO3108.1	2	-	-	-	-	2	-	-	-	-	-	-
CO3108.2	2	-	-	-	-	2	2	-	-	-	-	-
CO3108.3	2	-	-	-	-	2	2	-	-	-	-	-
CO3108.4	2	-	-	-	-	1	-	-	-	-	-	-
CO3108.5	2	-	-	-	-	2	2	-	-	-	-	-

### COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO3108.1	2	-	-	-	2
CO3108.2	2	-	-	-	2
CO3108.3	2	-	1	-	2
CO3108.4	2	-	-	-	2
CO3108.5	1	-	-	-	-

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development / Entrepreneur

**COURSE OVERVIEW AND OBJECTIVES:** The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work. Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR's

**COURSE OUTCOME:**

CO3109.1 To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.

CO3109.2 To disseminate knowledge on patents, patent regime in India and abroad and registration aspects

CO3109.3 To acquire knowledge on copyrights and its related rights and registration aspects

CO3109.4 To understand knowledge on trademarks and registration aspects

CO3109.5 To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects

**A. OUTLINE OF COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	INTRODUCTION TO IPR	9
2.	TYPES OF IPR AND WIPO	8
3.	LEGAL AND COMMERCIAL ASPECTS OF IPR	9
4.	INTRODUCTIONS TO PATENTS	9
5.	PATENT PROCEDURES	9

**B. DETAILED SYLLABUS**

Unit	Unit details
<b>Unit 1</b>	<b>INTRODUCTION TO IPR</b> General Regime of Intellectual Property Rights, Concept of Property vis-à-vis Intellectual Property, Concept of Property and Theories of Property - An Overview. Theories of Intellectual Property Rights, Intellectual Property as an Instrument of Development, Need for Protecting. Intellectual Property- Policy Consideration-National Perspectives and International demands.
<b>Unit 2</b>	<b>TYPES OF IPR AND WIPO</b> Types of Intellectual Property- Origin and Development- An Overview, Intellectual Property Rights as Human Right, Role of International Institutions, World Intellectual Property Organization (WIPO), Function of WIPO, Membership of WIPO, Agreement between the WIPO and the WTO.
<b>Unit 3</b>	<b>LEGAL AND COMMERCIAL ASPECTS OF IPR</b> Dispute Settlement- New Treaties, Commercialization of Intellectual Property Rights by Licensing, Determining Financial Value of Intellectual Property Rights, Negotiating Payments Terms in Intellectual Property Transaction, Intellectual Property Rights in the Cyber World.

<b>Unit 4</b>	<b>INTRODUCTIONS TO PATENTS</b> Introduction to Patent Law, Paris Convention, Patent Cooperation Treaty, WTO- TRIPS, Harmonization of CBD and TRIPs, Indian Patent Law, The Patents Act, 1970, Amendments to the Patents Act, Patentable Subject Matter, Patentability Criteria.
<b>Unit 5</b>	<b>PATENT PROCEDURES</b> Procedure for Filing Patent Applications, Patent Granting Procedure, Revocation, Patent Infringement and Remedies, Relevant Provisions of the Biological Diversity Act, 2002, Access and Benefit Sharing Issues.

### C. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Intellectual Property Rights in India	VK Ahuja (Lexis Nexis butter worths Publications)
Important Web Link:		
1.	<a href="https://www.cencenelec.eu/ipr/Pages/default.aspx">https://www.cencenelec.eu/ipr/Pages/default.aspx</a>	
2.	<a href="http://www.ipindia.nic.in/">http://www.ipindia.nic.in/</a>	
3.	<a href="https://en.wikipedia.org/wiki/Intellectual_property">https://en.wikipedia.org/wiki/Intellectual_property</a>	
4.	<a href="https://en.wikipedia.org/wiki/Intellectual_propert">https://en.wikipedia.org/wiki/Intellectual_propert</a>	
5.	<a href="https://www.itu.int/en/ITU-T/ipr/Pages/default.aspx">https://www.itu.int/en/ITU-T/ipr/Pages/default.aspx</a>	

### COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO3109.1	2	-	-	-	-	2	-	-	-	-	-	-
CO3109.2	2	-	-	-	-	2	2	-	-	-	-	-
CO3109.3	2	-	-	-	-	2	2	-	-	-	-	-
CO3109.4	2	-	-	-	-	1	-	-	-	-	-	-
CO3109.5	2	-	-	-	-	2	2	-	-	-	-	-

### COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO3109.1	2	-	-	-	2
CO3109.2	2	-	-	-	2
CO3109.3	2		1	-	2
CO3109.4	2	-	-	-	2
CO3109.5	1	-	-	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development / Entrepreneur

**COURSE OVERVIEW AND OBJECTIVES:** To understand the basic concepts associated with the design and Functioning and applications of Robots To study about the drives and sensors used in Robots To learn about analyzing robot kinematics and robot programming.

**COURSE OUTCOME:**

The student would be able to:

CO3110.1 To be able to introduce basics of robotics.

CO3110.2 To understand robot kinematics and robot programming

CO3110.3 To understand the application of Robots

CO3110.4 To learn about force and torque sensing

CO3110.5 To acquire knowledge of robotics programming.

**A. OUTLINE OF COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	FUNDAMENTALS	9
2.	ROBOT KINEMATICS	9
3.	ROBOT DYNAMIC ANALYSIS AND FORCES	8
4.	ACTUATORS AND SENSORS	9
5.	ROBOT PROGRAMMING, SYSTEMS AND APPLICATIONS	9

**B. Detailed Syllabus**

Unit	Unit details
Unit 1	<b>FUNDAMENTALS</b> Historical information, robot components, Robot characteristics, Robot anatomy, Basic structure of robots, Resolution, Accuracy and repeatability, Position Analysis forward and inverse kinematics of robots, Including frame representations.
Unit 2	<b>ROBOT KINEMATICS</b> Transformations, position and orientation analysis and the Denavit-Hartenberg representation of robot kinematics, The manipulators, The wrist motion and grippers. Differential motions, Inverse Manipulator Kinematics: Differential motions and velocity analysis of robots and frames.
Unit 3	<b>ROBOT DYNAMIC ANALYSIS AND FORCES</b> Analysis of robot dynamics and forces, Lagrangian mechanics is used as the primary method of analysis and development. Trajectory Planning: Methods of path and trajectory planning, Both in joint-space and in Cartesian-space.
Unit 4	<b>ACTUATORS AND SENSORS</b> Actuators, including hydraulic devices, Electric motors such as DC servo motors and stepper motors, Pneumatic devices, as well as many other novel actuators, It also covers microprocessor control of these actuators, Mechatronics, Tactile sensors, Proximity and range sensors, Force and torque sensors, Uses of sensors in robotics.

<b>Unit 5</b>	<b>ROBOT PROGRAMMING, SYSTEMS AND APPLICATIONS</b>
	Robot languages, Method of robots programming, Lead through programming methods, A robot programs as a path in space, Motion interpolation, WAIT, SIGNAL and DELAY commands, Branching capabilities and limitation of lead through methods and robotic applications. Basic principles of fuzzy logic and its applications in microprocessor control and robotics.

**C. RECOMMENDED STUDYMATERIAL:**

S.No	Title of the Book	Author
1.	Robotics Control Sensing, Vision and Intelligence	McGraw Hill Gonzalez, R. C., Fu, K. S. and Lee, C.S.G.
2.	Robotics for Engineers	McGraw Hill Koren, Y
3.	Introduction to Robotics, Analysis, Systems, Applications,	Dorling Kingsley, Dorling Kingsley Niku, S.B
4.	Programming robot controllers	McGraw Hill Predko, M

Important Web Links:

1.	<a href="https://nptel.ac.in/courses/112/105/112105249/">https://nptel.ac.in/courses/112/105/112105249/</a>
2.	<a href="https://nptel.ac.in/courses/112/101/112101099/">https://nptel.ac.in/courses/112/101/112101099/</a>
3.	<a href="https://nptel.ac.in/courses/112/101/112101098/">https://nptel.ac.in/courses/112/101/112101098/</a>
4.	<a href="https://swayam.gov.in/nd1_noc20_me03">https://swayam.gov.in/nd1_noc20_me03</a>
5.	<a href="https://www.youtube.com/watch?v=DaWMvEY3Qgc">https://www.youtube.com/watch?v=DaWMvEY3Qgc</a>

**COs AND POs MAPPING**

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO3110.1	2	-	-	-	-	2	-	-	-	-	-	-
CO3110.2	2	-	-	-	-	2	2	-	-	-	-	-
CO3110.3	2	-	-	-	-	2	2	-	-	-	-	-
CO3110.4	2	-	-	-	-	1	-	-	-	-	-	-
CO3110.5	2	-	-	-	-	2	2	-	-	-	-	-

**COs AND PSOs MAPPING**

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO3110.1	2	-	-	-	2
CO3110.2	2	-	-	-	2
CO3110.3	2	-	1	-	2
CO3110.4	2	-	-	-	2
CO3110.5	1	-	-	-	-

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development / Entrepreneur

**COURSE OVERVIEW AND OBJECTIVES:** The Digital India programme aims to provide broadband highways, universal access to mobile connectivity, public internet access programme, e-governance: Reforming government through technology, eKranti - Electronic delivery of services, Information for all, Electronics manufacturing: Target net zero imports, IT for jobs and early harvest programmes

**COURSE OUTCOME:**

At the end of the course students will be able to:

CO3111.1. Understand concepts and objectives digital India and digital infrastructure.

CO3111.2 Understand the pillars of the digital India.

CO3111.3 Understand the concept of new digital services and platforms for implementations purpose.

CO3111.4 Understand the various digital facilities to empower citizen.

CO3111.5 Apply the digital India initiative for training objective.

**A. OUTLINE OF THE COURSE**

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Digital India Initiative	8
2.	Focus Area	8
3.	Implementation	9
4.	Facilities To Digitally Empower Citizen	7
5.	Training	8

**B. DETAILED SYLLABUS**

Unit	Unit Details
<b>1.</b>	<b>Digital India Initiative</b>
	Concept, aims and objectives, opportunities, inclusive growth in areas of electronic services, products, manufacturing and job opportunities, centered on three key areas – Digital Infrastructure as a Utility to Every Citizen, Governance & Services on Demand and Digital Empowerment of Citizens.
<b>2.</b>	<b>Focus Area</b>
	The Government of India specifically targets nine 'Pillars of the Digital India' as follows: Broadband Highway, Universal Access to Mobile connectivity, Public Internet Access Programme, E-Governance, reforming Government through Technology, E- Kranti, electronic delivery of services, Information for All, Electronics Manufacturing, IT for Jobs
<b>3.</b>	<b>Implementation</b>
	New digital services, MyGov.in is a platform to share inputs and ideas on matters of policy and governance, UMANG (Unified Mobile Application for New-age Governance) ,AADHAR,Digi-Locker,BharatBill Payment System, PAN, EPFO services, PMKVY services, Indian railway tickets bookings, birth certificates, e-District, e-Panchayat, e-Sign framework, Swachh Bharat Mission(SBM) Mobile app, e-Hospital application, Digital attendance.
<b>4.</b>	<b>Facilities To Digitally Empower Citizen</b>
	Digital locker facility, eliminating the use of physical documents and enables the sharing of verified electronic documents across government agencies, three key stakeholders of citizen, issuer and requester. BPO and job growth, government is planning to create 28,000 seats of bpos in various states and set up at least one common service centre in each of the gram panchayats in the state.Easy access to a common services center (CSC), Shareable private space on a public cloud, Safe and secure cyberspace, Universally accessible digital resources, Collaborative digital platforms for intergovernmental operations. E- Sampark vernacular email service: connect rural India with the

	digital India, the government of India impelled email services provider giants including Gmail, office and rediff to provide the email address in regional languages, an Indian-based company, data Xgen technologies pvt.ltd, has launched world's first free linguistic email address under the name „Data mail“ which allows creating email ids in 8 Indian languages, English; and 3 foreign languages – Arabic, Russian and Chinese. Over the period of time the email service in 22 languages will be offered by Data Xgen technologies.
<b>5.</b>	<b>Training</b>
	PradhanMantriGramin, Digital SakshartaAbhiyan, PMG Disha, Ongoing awareness campaign, reception within country and the outside world, criticism and impact.

**C. RECOMMENDED STUDY MATERIAL:**

S.No	Book	Author	Publication
<b>a. Reference Books</b>			
1.	Digital India: Understanding Information, Communication and Social Change	PradipNinan Thomas	SAGE
2.	Book on Digital India (Special Edition) by National e-governance mission, Government of India		
Important Web Links:			
1.	<a href="https://economictimes.indiatimes.com/tech/internet/digital-india-15-salient-things-to-know-about-pm-narendra-modis-project/articleshow/47893380.cms">https://economictimes.indiatimes.com/tech/internet/digital-india-15-salient-things-to-know-about-pm-narendra-modis-project/articleshow/47893380.cms</a>		
2.	<a href="https://en.wikipedia.org/wiki/Digital_India">https://en.wikipedia.org/wiki/Digital_India</a>		
3.	<a href="https://www.researchgate.net/publication/303643369_Digital_India_Objectives_Initiatives_and_Inherent_Challenges">https://www.researchgate.net/publication/303643369_Digital_India_Objectives_Initiatives_and_Inherent_Challenges</a>		
4.	<a href="https://digitalindia.gov.in/content/programme-pillars">https://digitalindia.gov.in/content/programme-pillars</a>		
5.	<a href="https://www.civilserviceindia.com/subject/Essay/digital-india-or-green-india-discuss3.html">https://www.civilserviceindia.com/subject/Essay/digital-india-or-green-india-discuss3.html</a>		

**D.CO's AND PO's MAPPING**

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO3111.1	2	-	-	-	-	2	-	-	-	-	-	-
CO3111.2	2	-	-	-	-	2	2	-	-	-	-	-
CO3111.3	2	-	-	-	-	2	2	-	-	-	-	-
CO3111.4	2	-	-	-	-	1	-	-	-	-	-	-
CO3111.5	2	-	-	-	-	2	2	-	-	-	-	-

**E.CO's AND PSO's MAPPING**

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO3111.1	2	-	-	-	2
CO3111.2	2	-	-	-	2
CO3111.3	2	-	1	-	2
CO3111.4	2	-	-	-	2
CO3111.5	1	-	-	-	-

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development / Entrepreneur



**COURSE OVERVIEW AND OBJECTIVES:**

The objective of the Smart Cities **Mission** is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and **application** of 'Smart' Solutions.

**COURSE OUTCOME:**

At the end of the course students will be able to:

CO3112.1 Understand the concept of smart city and smart energy business concepts.

CO3112.2 Apply governance of smart city by various techniques like Augmented Reality for City Planning.

CO3112.3. Understand the concept and characteristics of Smart City Intelligent Buildings and Urban Spaces.

CO3112.4 Understand the environmental and economic impacts on buildings by Multi-objective optimization.

CO3112.5 Apply the energy management and Smart City Distributed Energy.

**A. OUTLINE OF THE COURSE**

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Smart City Introduction And Concept	7
2.	Smart City Governance	8
3.	Smart City Intelligent Buildings And Urban Spaces	7
4.	Multi Objective Optimization- Smart City	7
5.	Smart City Distributed Energy	8

**B. DETAILED SYLLABUS**

Unit	Unit Details
<b>1.</b>	<b>Smart City Introduction And Concept</b>
	Smart City: local but networked, distributed but integrated Smart City, City monitoring and operation systems. Vision of an open smart city inter-operability environment Road maps for research and innovation policy Smart energy business concepts for Energy Hub districts Identifying development trends in smart city technologies – VTT Trend generator Public procurement of innovation for smart city solutions.
<b>2.</b>	<b>Smart City Governance</b>
	Real-time decision support systems for city management, Boosting collaborative planning with visualisation technology, Virtual Model Facilitating Citizen Interaction, Mobile Augmented Reality for City Planning, Co-creating future smart cities - Visual and participative urban planning services Citizen-driven co- design for a smarter city Social media for citizen participation Gamification as an enabler of mutual learning in complex health care systems Decision-making support: A smart city perspective
<b>3.</b>	<b>Smart City Intelligent Buildings And Urban Spaces</b>
	Intelligent buildings and urban spaces in smart cities Intelligent urban spaces– automatic real-time responses to people behavior Occupancy in smart buildings of smart cities – case hospital smart lighting Mobile augmented reality for building maintenance Autonomous management system for buildings and districts
<b>4.</b>	<b>Multi Objective Optimization- Smart City</b>

	Multi-objective optimization for the minimization of environmental and economic impacts on buildings at district level Intelligent Street lights adapt to conditions City mills leading the positive change in recycling.
<b>5.</b>	<b>Smart City Distributed Energy</b>
	Distributed renewable energy and energy management Highlights from the Smart Grids and Energy Systems programme. Active distribution networks with full integration of demand and distributed resources Integration of variable power generation into urban energy systems Future district heating solutions for residential districts Smart metering cyber security ICT for neighborhoods" energy management Energy-Hub for residential and commercial districts and transport ICT-supported business in energy positive neighborhood"s Renewable energy and energy efficiency in new districts – how to accelerate systemic change towards smart cities Internet of Energy: Electric Mobility with Smart Grids.

### C. RECOMMENDED STUDY MATERIAL:

S.No	Book	Author	Publication
<b>a. Reference Books</b>			
1.	Building smart cities-Analytics, design building and thinking	Carol I. Stimmel	Auerbach Publications
2.	Smart City- Foundation, principles and application	Houbing Song	JOHN WILEY
3.	Smart city and urban development of India	N. Mani	New Century Publications
<b>b. Important Web Links:</b>			
1.	<a href="https://nptel.ac.in/courses/105/105/105105160/">https://nptel.ac.in/courses/105/105/105105160/</a>		
2.	<a href="https://nptel.ac.in/courses/124/107/124107007/">https://nptel.ac.in/courses/124/107/124107007/</a>		
3.	<a href="https://swayam.gov.in/nd1_noc20_ce43/preview">https://swayam.gov.in/nd1_noc20_ce43/preview</a>		
4.	<a href="https://www.youtube.com/watch?v=8G8ewFxE_V8">https://www.youtube.com/watch?v=8G8ewFxE_V8</a>		
5.	<a href="http://www.digimat.in/nptel/courses/video/105105160/L41.html">http://www.digimat.in/nptel/courses/video/105105160/L41.html</a>		

### D.CO's AND PO's MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO3112.1	1	-	-	-	-	2	2	-	-	-	-	-
CO3112.2	2	-	-	1	1	1	1	-	-	-	-	-
CO3112.3	2	1	1	1	-	1	-	-	1	-	1	-
CO3112.4	2	-	-	1	-	1	-	-	1	-	-	1
CO3112.5	-	-	2	-	1	2	-	-	-	-	1	-

### E.CO's AND PO's MAPPING

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO3112.1	3	1	1	1	1
CO3112.2	1	-	3	-	2
CO3112.3	2	2	-	2	1
CO3112.4	1	1	1	-	2
CO3112.5	1	1	3	2	-

**Note:** On the basis of mapping of COs with POs, this course is related to Skill Development / Entrepreneur

**COURSE OVERVIEW AND OBJECTIVES**

The course should enable the students to:

1. Understand the various forms of conventional energy resources.
2. Learn the present energy scenario and the need for energy conservation
3. Explain the concept of various forms of renewable energy
4. Outline division aspects and utilization of renewable energy sources for both domestics and industrial application
5. Analyse the environmental aspects of renewable energy resources.

**COURSE OUTCOME**

**The student would be able to**

**CO03113.1** Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations

**CO03113.2** Know the need of renewable energy resources, historical and latest developments.

**CO03113.3** Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc

**CO03113.4** Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.

**CO03113.5** Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications

**B. OUTLINE OF COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	CLASSIFICATION OF ENERGY	9
2	APPLICATIONS OF SOLAR ENERGY	10
3	BIO ENERGY SOURCES	8
4	WIND ENERGY & SMALL HYDRO POWER SYSTEMS	10
5	OCEAN & GEOTHERMAL ENERGY	7

**C. Detailed Syllabus**

Unit No.	Description
<b>UNIT 1</b>	<b>CLASSIFICATION OF ENERGY</b> Energy chain and common forms of usable energy- Present energy scenario-World energy status-Energy scenario in India - Introduction to renewable energy resources Introduction to Solar Energy-Energy from sun-Spectral distribution of Solar radiation- Instruments for measurement of solar radiation-Solar radiation data analysis

<b>UNIT 2</b>	<p><b>APPLICATIONS OF SOLAR ENERGY</b>  Thermal applications -Introduction to Solar thermal collectors- Types - Principle of operation of different collectors - Flat plate- Evacuated tube collectors-Compound parabolic collectors- Solar air heaters - Solar dryers-solar cookers- solar stills - Solar ponds - concentrating collectors- line type - point type - Methods of Solar power generation - Power towers. Physics of solar cells - Cell and module Characteristics of cells and module - Performance parameters -BoS- PV System applications - Stand- alone- Grid connected systems</p>
<b>UNIT 3</b>	<p><b>BIO ENERGY SOURCES</b>  Energy through various processes - Energy through fermentation - Gasification - various types of gasifiers -Pyrolysis - Fixed bed and fast Pyrolysis - Bio energy through digestion - Types of Digesters- Factors affecting the yield of products</p>
<b>UNIT 4</b>	<p><b>WIND ENERGY &amp; SMALL HYDRO POWER SYSTEMS</b>  Resource assessment - types of wind turbines - selection of components - blade materials - power regulation - various methods of control - wind farms - site selection - off shore wind farms - Solar Wind Hybrid energy systems. Introduction - types - system components, discharge curve and estimation of power potential- Turbines for SHP</p>
<b>UNIT 5</b>	<p><b>OCEAN &amp; GEOTHERMAL ENERGY</b>  Power generation through OTEC systems - various types - Energy through waves and tides - Energy generation through geothermal systems - types</p>

**D. COs AND POs MAPPING**

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO3113.1	3	2	1	1	-	1	-	-	-	-	-	-
CO3113.2	3	2	3	-	1	-	-	-	-	-	-	-
CO3113.3	2	2	3	1	1	-	-	-	-	-	-	-
CO3113.4	1	3	-	2	2	1	-	-	-	-	-	-
CO3113.5	1	1	2	3	1	-	-	-	-	-	-	-

**E. COs AND PSOs MAPPING**

COs and PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO3113.1	3	2	-	-	2
CO3113.2	-	3	2	-	1
CO3113.3	2	3	-	1	-
CO3113.4	1	3	-	2	-
CO3113.5	-	3	2	-	2

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

The Project can be carried out in the Institution/Industry/Research laboratory or any other competent institutions.

**POORNIMA UNIVERSITY, JAIPUR**

**Faculty of Engineering and Technology**

**Name of Program:** M.Tech. in Transportation Engineering      **Duration:** 2 Years      **Total Credits:** 80

**Teaching Scheme for Batch 2023-25**

**Semester-IV**

Course Code	Name of Course	Teaching Scheme				Marks Distribution			Credits	
		Lecture (L)	Tutorial (T)	Practical	SH	IE	ESE	Total		
<b>A.</b>		<b>Major (Core Courses)</b>								
<b>A.1</b>	<b>Theory</b>									
-	-	-	-	-	-	-	-	-	-	
<b>A.2</b>	<b>Practical</b>									
-	-	-	-	-	-	-	-	-	-	
<b>B.</b>		<b>Minor Stream Courses/ Department Electives/ <i>Core Elective</i></b>								
<b>B.1</b>	<b>Theory</b>									
-	-	-	-	-	-	-	-	-	-	
<b>B.2</b>	<b>Practical</b>									
-	-	-	-	-	-	-	-	-	-	
<b>C</b>		<b>Multidisciplinary Courses</b>								
-	-	-	-	-	-	-	-	-	-	
<b>D</b>		<b>Ability Enhancement Courses (AEC)</b>								
-	-	-	-	-	-	-	-	-	-	
<b>E</b>		<b>Skill Enhancement Courses (SEC)</b>								
-	-	-	-	-	-	-	-	-	-	
<b>F</b>		<b>Value Added Courses (VAC)</b>								
-	-	-	-	-	-	-	-	-	-	
<b>G</b>		<b>Summer Internship / Research Project / Dissertation</b>								
MTECCV4401	Dissertation Part - II	-	-	30		250	250	500	15	
<b>Total</b>		0	0	30					<b>15</b>	
<b>Total Teaching Hours</b>		<b>30</b>								

The Project can be carried out in the Institution/Industry/Research laboratory or any other competent institutions.