

**ACADEMIC REGULATIONS,
COURSE STRUCTURE
and
DETAILED SYLLABUS**

CHOICE BASED CREDIT SYSTEM

R21

M.Tech – Highway Engineering

**M.Tech - Regular Two Year Degree Programme
(For batches admitted from the academic year 2021 - 2022)**



Holy Mary Institute of Technology & Science

Bogaram (V), Keesara (M), Medchal (Dist) - 501 301

FOREWORD

The autonomy is conferred on Holy Mary Institute of Technology & Science by UGC based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like UGC and AICTE. It reflects the confidence of the UGC in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

Holy Mary Institute of Technology & Science is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a two decades in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the College and recommendations of the JNTU Hyderabad to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the college to order to produce quality engineering graduates to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications, if needed, are to be sought, at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

ACADEMIC REGULATIONS

**M. Tech. - Regular Two Year Degree Programme
(For batches admitted from the academic year 2021 - 22)**

For pursuing two year post graduate Masters Degree Programme of study in Engineering (M.Tech) offered by Holy Mary Institute of Technology & Science under Autonomous status and herein referred to as HITS (Autonomous):

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2021-22 onwards. Any reference to “Institute” or “College” in these rules and regulations shall stand for Holy Mary Institute of Technology & Science (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, Holy Mary Institute of Technology & Science shall be the Chairman, Academic Council.

1. ADMISSION

Admission into first year of two year M. Tech. degree Program of study in Engineering:

Eligibility:

Admission to the above programme shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the University or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt., From time to time.

The medium of instructions for the entire post graduate programme in Engineering & technology will be English only.

2. AWARD OF M. Tech. DEGREE

A student shall be declared eligible for the award of the M. Tech. Degree, if he pursues a course of study in not less than two and not more than four academic years. However, he is permitted to write the examinations for two more years after two academic years of course work, failing which he shall forfeit his seat in M. Tech. programme.

The student shall register for all 68 credits and secure all the 68 credits.

The minimum instruction days in each semester are 90.

3. BRANCH OF STUDY

The following specializations are offered at present for the M. Tech programme of study.

1. Highway Engineering
2. CSE
3. Computer Networks & Information Security
4. Embedded Systems
5. VLSI Design
6. Electrical Power Systems
7. Power Electronics
8. CAD / CAM
9. Machine Design

4. COURSE REGISTRATION

- 4.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him on the Post Graduate Programme (PGP), its Course Structure and Curriculum, Choice / Option for Courses, based on his competence, progress, pre-requisites and interest.
- 4.2 Academic Section of the College invites 'Registration Forms' from students within 15 days from the commencement of class work, ensuring 'DATE and TIME Stamping'. The Registration Requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.
- 4.3 A Student can apply Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of it being retained with Head of Department, Faculty Advisor and the Student).
- 4.4 If the Student submits ambiguous choices or multiple options or erroneous entries - during Registration for the Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Course in that Category will be taken into consideration.
- 4.5 Course Registrations are final and CANNOT be changed, nor can they be inter-changed; further, alternate choices will also not be considered. However, if the Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new course (subject to offering of such a course), or for another existing course (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

5. ATTENDANCE

The programmes are offered on a unit basis with each subject being considered a unit.

- 5.1 Attendance in all classes (Lectures/Laboratories etc.) is compulsory. The minimum required attendance in each theory / Laboratory etc. is 75% including the days of attendance in sports, games, NCC and NSS activities for appearing for the End Semester examination. A student shall not be permitted to appear for the Semester End Examinations (SEE) if his attendance is less than 75%.
- 5.2 Condonation of shortage of attendance in each subject up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee.
- 5.3 Shortage of Attendance below 65% in each subject shall not be condoned.
- 5.4 Students whose shortage of attendance is not condoned in any subject are not eligible to write their end semester examination of that subject and their registration shall stand cancelled.
- 5.5 A prescribed fee shall be payable towards condonation of shortage of attendance.
- 5.6 A Candidate shall put in a minimum required attendance at least three (3) theory courses in I Year I semester for promoting to I Year II Semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements of the courses, as per the course structure.
- 5.7 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present Semester, as applicable. They may seek readmission into that

semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission in to the same class.

6. EVALUATION

The performance of the candidate in each semester shall be evaluated course-wise, with a maximum of 100 marks for theory and 100 marks for practical's, on the basis of Internal Evaluation and End Semester Examination.

- For the theory courses 70 marks shall be awarded for the performance in the Semester End Examination and 30 marks shall be awarded for Continuous Internal Evaluation (CIE). The Continuous Internal Evaluation shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted, one in the middle of the Semester and the other, immediately after the completion of Semester instructions. Each mid-term examination shall be conducted for a total duration of 120 minutes.

Continuous Internal Examination (CIE)

- Subjective Paper shall contain three questions. Question 1 & 2 with internal choice from unit-I, question 3 & 4 with internal choice from unit-II and question no 5 & 6 may be having a, b sub questions with internal choice from first half part of unit-III for CIE-I. For CIE-II 1 & 2 questions from unit-4, questions 3 & 4 from unit-5 and question no 5 & 6 from remaining half part of unit-3. The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus. Question no. 1 to 6 carries 10 Marks.

Semester End Examination (SEE)

- The Semester End Examination will be conducted for 70 marks examination shall be conducted for a total duration of 180 minutes. Question paper consists of Part–A and Part-B with the following.
 - Part-A is a compulsory question consisting of 5 questions, one from each unit and carries 4 marks each.
 - Part-B to be answered 5 questions carrying 10 marks each. There will be two questions from each unit and only one should be answered.
- 6.1 For practical courses, 70 marks shall be awarded for performance in the Semester End Examinations and 30 marks shall be awarded for day-to-day performance as Internal Marks.
- 6.2 For conducting laboratory end examinations of all PG Programmes, one internal examiner and one external examiner are to be appointed by the Chief Controller of Examination in one week before for commencement of the lab end examinations.
- 6.3 There shall be a seminar presentations during II year I semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful. If he fails to fulfill minimum marks, he has to reappear during the supplementary examinations.

- 6.4 A candidate shall be deemed to have secured the minimum academic requirement in a Course if he secures a minimum of 40% of marks in the Semester End Examination and a minimum aggregate of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together.
- 6.5 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 6.6) he has to re appear for the Semester End Examination in that course.
- 6.6 A candidate shall be given one chance to re-register for the courses if the internal marks secured by a candidate is less than 50% and failed in that course for maximum of two courses and should register within four weeks of commencement of the class work. In such a case, the candidate must re-register for the courses and secure the required minimum attendance. The candidate's attendance in the re-registered course(s) shall be calculated separately to decide upon his eligibility for writing the Semester End Examination in those courses. In the event of the student taking another chance, his Continuous Internal Evaluation (internal) marks and Semester End Examination marks obtained in the previous attempt stands cancelled.
- 6.7 In case the candidate secures less than the required attendance in any course, he shall not be permitted to write the Semester End Examination in that course. He shall re-register for the course when next offered.
- 6.8 Offering one open elective courses in III-Semester along with core and specialized courses as a part of inculcating knowledge to the student.

7. EXAMINATIONS AND ASSESSMENT - THE GRADING SYSTEM

- 7.1 Marks will be awarded to indicate the performance of each student in each Theory Course, or Lab/Practicals, or Seminar, or Project, etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 6 above, and a corresponding Letter Grade shall be given.
- 7.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed:

<i>% of Marks Secured (Class Intervals)</i>	<i>Letter Grade (UGC Guidelines)</i>	<i>Grade Points</i>
90% and above ($\geq 90\%$, $\leq 100\%$)	O (Outstanding)	10
Below 90% but not less than 80% ($\geq 80\%$, $< 90\%$)	A ⁺ (Excellent)	9
Below 80% but not less than 70% ($\geq 70\%$, $< 80\%$)	A (Very Good)	8
Below 70% but not less than 60% ($\geq 60\%$, $< 70\%$)	B ⁺ (Good)	7
Below 60% but not less than 50% ($\geq 50\%$, $< 60\%$)	B (above Average)	6
Below 50% ($< 50\%$)	F (FAIL)	0
Absent	AB	0

- 7.3 A student obtaining F Grade in any Course shall be considered ‘failed’ and is be required to reappear as ‘Supplementary Candidate’ in the Semester End Examination (SEE), as and when offered. In such cases, his Internal Marks (CIE Marks) in those Courses will remain the same as those he obtained earlier.
- 7.4 A student not appeared for examination then ‘AB’ Grade will be allocated in any Course shall be considered ‘failed’ and will be required to reappear as ‘Supplementary Candidate’ in the Semester End Examination (SEE), as and when offered.
- 7.5 A Letter Grade does not imply any specific Marks percentage and it will be the range of marks percentage.
- 7.6 In general, a student shall not be permitted to repeat any Course(s) only for the sake of ‘Grade Improvement’ or ‘SGPA / CGPA Improvement’.
- 7.7 A student earns Grade Point (GP) in each Course, on the basis of the Letter Grade obtained by him in that Course. The corresponding ‘Credit Points’ (CP) are computed by multiplying the Grade Point with Credits for that particular Subject / Course.

$$\text{Credit Points (CP)} = \text{Grade Point (GP)} \times \text{Credits} \dots \text{ For a Course}$$

- 7.8 The Student passes the Course only when he **gets GP ≥ 6 (B Grade or above)**.
- 7.9 A student earns Grade Point (GP) in each Course, on the basis of the Letter Grade obtained by him in that Course (excluding Mandatory non-credit Courses). Then the corresponding ‘Credit Points’ (CP) are computed by multiplying the Grade Point with Credits for that particular Course.

$$\text{Credit Points (CP)} = \text{Grade Point (GP)} \times \text{Credits} \dots \text{ For a Course}$$

- 7.10 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (Σ CP)secured from ALL Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

$$\text{SGPA} = \frac{\{\sum_{i=1}^N C_i G_i\}}{\{\sum_{i=1}^N C_i\}} \dots \text{ For each Semester,}$$

where ‘i’ is the Course indicator index (takes into account all Courses in a Semester), ‘N’ is the no. of Courses ‘REGISTERED’ for the Semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to that ix Course, and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that its Course.

Illustration of Computation of SGPA

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course1	3	A	8	3 x 8 = 24
Course2	3	B+	7	4 x 7 = 28
Course3	3	B	6	3 x 6 = 18
Course4	3	O	10	3 x 10 = 30
Course5	3	C	5	3 x 5 = 15
Course6	3	B	6	4 x 6 = 24

Thus, **SGPA = 139/18 = 7.72**

7.11 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, at the end of each Semester, as per the formula

$$\text{CGPA} = \left\{ \sum_{j=1}^M C_j G_j \right\} / \left\{ \sum_{j=1}^M C_j \right\} \dots \text{ for all } S \text{ Semesters registered}$$

(i.e., up to and inclusive of S Semesters, S ≥ 2)

where ‘M’ is the TOTAL no. of Courses (as specifically required and listed under the Course Structure of the parent Department) the Student has ‘REGISTERED’ from the 1st Semester onwards upto and inclusive of the Semester S (obviously M > N), ‘j’ is the Course indicator index (takes into account all Courses from 1 to S Semesters), C_j is the no. of Credits allotted to the jth Course, and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth Course. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

For CGPA Computation

Semester 1	Semester 2	Semester 3	Semester 4
Credits : 18 SGPA : 7.72	Credits : 18 SGPA : 7.8	Credits : 12 SGPA : 5.6	Credits : 20 SGPA : 6.0

$$\text{Thus, CGPA} = \frac{18 \times 7.72 + 18 \times 7.8 + 12 \times 5.6 + 20 \times 6.0}{68} = 6.86$$

7.12 For Calculations listed in Item 7.6 – 7.10, performance in failed Courses (securing F Grade) will also be taken into account, and the Credits of such Courses will also be included in the multiplications and summations.

7.13 No SGPA/CGPA is declared, if a candidate is failed in any one of the courses of a given semester.

7.14 Conversion formula for the conversion of GPA into indicative percentage is

$$\% \text{ of marks scored} = (\text{final CGPA} - 0.50) \times 10$$

8. EVALUATION OF PROJECT/DISSERTATION WORK

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

8.1 A Project Review Committee (PRC) shall be constituted with Head of the Department as Chairperson, Project Supervisor and one senior faculty member of the Departments offering the M. Tech. programme.

8.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses, both theory and practical.

8.3 After satisfying 8.2, a candidate has to submit, in consultation with his Project Supervisor, the title, objective and plan of action of his project work to the PRC for approval. Only after obtaining the approval of the PRC the student can initiate the Project work.

8.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

- 8.5 A candidate shall submit his project status report in two stages at least with a gap of three months between them.
- 8.6 The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.
- 8.7 After approval from the PRC, the soft copy of the thesis should be submitted to the College for ANTI-PLAGIARISM for the quality check and the plagiarism report should be included in the final thesis. If the copied information is less than 30%, then only thesis will be accepted for submission.
- 8.8 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College.
- 8.9 For Dissertation Phase-I in II Year I Sem. there is an internal marks of 100, the evaluation should be done by the PRC for 50 marks and Supervisor will evaluate for 50 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work and Literature Survey in the same domain. A candidate has to secure a minimum of 50% of marks to be declared successful for Project Phase-I. If he fails to fulfill minimum marks, he has to reappear during the supplementary examination.
- 8.10 For Dissertation Phase-II (Viva Voce) in II Year II Sem. There is an internal marks of 50, the evaluation should be done by the PRC for 25 marks and Supervisor will evaluate for 25 marks. The PRC will examine the overall progress of the Project Work and decide the Project is eligible for final submission or not. There is an external marks of 150 and the same evaluated by the External examiner appointed by the Chief Controller of Examinations and he secures a minimum of 40% of marks in the Semester End Examination and a minimum aggregate of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together.
- 8.11 If he fails to fulfill as specified in 8.10, he will reappear for the Viva-Voce examination only after three months. In the reappeared examination also, fails to fulfill, he will not be eligible for the award of the degree.
- 8.12 The thesis shall be adjudicated by one examiner selected by the Chief Controller of Examinations. For this, the HOD of the Department shall submit a panel of 3 examiners, eminent in that field, with the help of the guide concerned and Head of the Department.
- 8.13 If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected.
- 8.14 If the report of the examiner is favorable, Project dissertation shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the Thesis.
- 8.15 The Head of the Department shall coordinate and make arrangements for the conduct of Project dissertation.
- 8.16 For Audit Course (Non-Credit Courses) offered in a Semester, after securing $\geq 65\%$ attendance and has secured not less than 40% marks in the SEE, and a minimum of 50% of marks in the sum Total of the CIE and SEE taken together in such a course, then the student is **PASS** and will be qualified for the award of the degree. No marks or Letter Grade shall

be allotted for these courses/activities. However, for non-credit courses ‘SATISFACTORY’ or “UNSATISFACTORY’ shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

9. AWARD OF DEGREE AND CLASS

9.1 A Student who registers for all the specified Courses/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of 68 Credits (with CGPA ≥ 6.0), shall be declared to have ‘QUALIFIED’ for the award of the M.Tech. Degree in the chosen Branch of Engineering and Technology with specialization as he admitted.

9.2 Award of Class

After a student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of M. Tech. Degree, he shall be placed in one of the following three classes based on the CGPA:

Class Awarded	Grade to be Secured
First Class with Distinction	CGPA ≥ 8.00
First Class	≥ 7.00 to < 8.00 CGPA
Second Class	≥ 6.00 to < 7.00 CGPA

9.3 A student with final CGPA (at the end of the PGP) < 6.00 will not be eligible for the Award of Degree.

10. WITHOLDING OF RESULTS

If the student has not paid the dues, if any, to the college or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be with held in such cases.

11. TRANSITORY REGULATIONS

- 11.1 If any candidate is detained due to shortage of attendance in one or more courses, they are eligible for re-registration to maximum of two earlier or equivalent courses at a time as and when offered.
- 11.2 The candidate who fails in any course will be given two chances to pass the same course; otherwise, he has to identify an equivalent course as per HITS21 Academic Regulations.

12 SUPPLEMENTARY EXAMINATIONS

Supplementary examinations for the odd semester shall be conducted with the regular examinations of even semester and vice versa, for those who appeared and failed or absent in regular examinations. Such candidates writing supplementary examinations may have to write more than one examination.

13. REVALUATION

Students shall be permitted for revaluation after the declaration of end semester examination results within due dates by paying prescribed fee. After revaluation if there is any betterment in the grade, then improved grade will be considered. Otherwise old grade shall be retained.

14. AMENDMENTS TO REGULATIONS

The Academic Council of Holy Mary Institute of Technology & Science reserves the right to revise, amend, or change the regulations, scheme of examinations, and / or syllabi or any other policy relevant to the needs of the society or industrial requirements etc., without prior notice.

15. GENERAL

- 15.1 **Credit:** A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.
- 15.2 **Credit Point:** It is the product of grade point and number of credits for a course.
- 15.3 Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”.
- 15.4 The academic regulation should be read as a whole for the purpose of any interpretation.
- 15.5 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman of the Academic Council is final.

**MALPRACTICES RULES - DISCIPLINARY ACTION FOR /IMPROPER
CONDUCT IN EXAMINATIONS**

S. No	Nature of Malpractices / Improper Conduct	Punishment
1 (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the course of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Principal.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is course to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

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4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is course to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	Refuses to obey the orders of the Addl. Controller of examinations / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the addl. Controller of examinations or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the addl. Controller of examinations, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is course to the academic regulations in connection with forfeiture of seat.

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8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the principal for further action to award suitable punishment.	

COURSE STRUCTURE

I M.Tech I Semester									
Course Code	Course Title	Category	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
B1HE101PC	Highway Policy & Planning	PC	3	-	-	3	30	70	100
B1HE102PC	Highway Material Characterization	PC	3	-	-	3	30	70	100
B1HE103PC	Evaluation of Strengthening of Pavements	PC	3	-	-	3	30	70	100
	Professional Elective – I	PE	3	-	-	3	30	70	100
	Professional Elective – II	PE	3	-	-	3	30	70	100
B1HE104PC	Pavement Materials Lab	PC	-	-	3	1.5	30	70	100
B1HE105PC	Traffic Analysis Lab	PC	-	-	3	1.5	30	70	100
TOTAL			15	-	6	18	210	490	700
Audit Course (Non-Credit)									
AC	Audit Course - I	AC	2	-	-	-	100	-	100

I M.Tech II Semester									
Course Code	Course Title	Category	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
B1HE201PC	Traffic Analysis	PC	3	-	-	3	30	70	100
B1HE202PC	Land Use & Transport Modeling	PC	3	-	-	3	30	70	100
B1HE203PC	Advanced Concrete Technology	PC	3	-	-	3	30	70	100
	Professional Elective – III	PE	3	-	-	3	30	70	100
	Professional Elective – IV	PE	3	-	-	3	30	70	100
B1HE204PC	Pavement Evaluation & Performance Lab	PC	-	-	3	1.5	30	70	100
B1HE205PC	Pavement Design Lab	PC	-	-	3	1.5	30	70	100
TOTAL			15	-	6	18	210	490	700
Audit Course (Non-Credit)									
AC	Audit Course - II	AC	2	-	-	-	100	-	100

M.Tech-Highway Engineering –HITS R21

II M.Tech I Semester									
Course Code	Course Title	Category	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
	Professional Elective - V	PE	3	-	-	3	30	70	100
	Open Elective	OE	3	-	-	3	30	70	100
B1HE301PC	Technical Seminar	PC	2	-	-	2	100	-	100
B1HE302PW	Dissertation Phase - I	PWC	-	-	16	8	100	-	100
TOTAL			8	-	16	16	260	140	400

II M.Tech II Semester									
Course Code	Course Title	Category	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
B1HE401PW	Dissertation Phase - II	PWC	-	-	32	16	50	150	200
TOTAL			-	-	32	16	50	150	200

Total Credits = 68

PROFESSIONAL ELECTIVES			
PE - I		PE - II	
B1HE101PE	Road Engineering	B1HE104PE	Pavement Design & Evaluation
B1HE102PE	Road Safety Engineering	B1HE105PE	Rural Roads
B1HE103PE	Modelling for Highway Simulation	B1HE106PE	Traffic Engineering
PE - III		PE - IV	
B1HE207PE	Project Formulation & Economics	B1HE210PE	Pavement Construction & Maintenance
B1HE208PE	Intelligent Transportation Systems	B1HE211PE	Road Safety and Supporting infra Structure Evaluation
B1HE209PE	Remote Sensing & GIS	B1HE212PE	Transportation Systems Management
PE - V			
B1HE313PE	Bridge Engineering		
B1HE314PE	Highway Infrastructure Design		
B1HE315PE	Urban Transport Economics Planning		

	OPEN ELECTIVES
B1HE301OE	GIS & IoT For Planning & Policy Making for Smart Cities/Urban Areas
B1HE302OE	Disaster Management
B1HE303OE	Construction Management
B1HE304OE	Industrial Safety

AUDIT COURSE I		AUDIT COURSE II	
B1HE101AC	English for Research Paper Writing	B1HE203AC	Disaster Management
B1HE102AC	Research Methodology and IPR	B1HE204AC	Personality Development Through Life Enlightenment Skills

DETAILED SYLLABUS

I-YEAR (I-SEMESTER)

HIGHWAY POLICY & PLANNING

I M.TECH-I SEMESTER

Course Code: BIHE101PC

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. The course introduces students to the fundamentals of Urban transportation planning.
2. It familiarizes students with contemporary transportation planning issues and methods of analysis.
3. Relationships between transportation and urban land use systems and new tools to address environmental and quality of life impacts of transportation are presented.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Identify Urban transportation problems and understand the principles of planning.
2. Organise and conduct various types of surveys
3. Apply travel demand estimation techniques
4. Plan sustainable urban mobility and evaluate alternate improvements.
5. Identify design issues in metropolitan cities.

UNIT-I INTRODUCTION

Role of transportation in the Economic development of Nations, Overview of transport modes, growth trends, National Transport Policy of India – Case studies, Transportation planning in the developing world; and comparative International transportation policies; Fundamentals of transportation , Principles of planning, evaluation, selection, adoption, financing, and implementation of alternative urban transportation systems; formulation of community goals and objectives, inventory of existing conditions; transportation modeling trip generation, distribution, modal choice, assignment

UNIT -II DATA COLLECTION AND INVENTORIES:

Collection of data – Organization of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population Employment – Vehicle Owner Ship.

UNIT -III TRAVEL DEMAND ISSUES:

Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Detailed approach on 4 step travel demand estimation; Sequential and Simultaneous Approaches, Aggregate and Disaggregate Techniques..

UNIT -IV DEMAND AND SUPPLY PLANNING:

Planning for sustainable urban mobility, positive and negative externalities in urban transport, congestion pricing, parking policy, demand management ,Urban travel and transportation system characteristics - a systems perspective, Data management and use in decision making , Demand analysis , Urban activity analysis, Supply analysis; Plan Preparation And Evaluation: Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities. Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis

UNIT -V METROPOLITAN CITIES:

Design issues in urban mobility, integrating land use and transport planning; Overview of urbanization process, city structure and urban activity and infrastructure systems, Economic and social significance of urban infrastructure systems; Transport's Role in tackling Social Inclusion, Economic Impacts of Transport Policy.

TEXT BOOKS

1. Introduction to Urban System Planning - B.G.Hutchinson; Mc Graw Hill.
2. Traffic Engineering and Transport Planning - Kadiyali L.R., Khanna Publishers

REFERENCE BOOKS

1. Introduction to Transportation Planning – M.J.Bruton; Hutchinson of London Ltd.
2. Lecture notes on UTP - Prof. S. Raghavachari , R.E.C.Warangal.
3. Metropolitan transportation planning – John W. Dickey, Tata Mc Graw Hill, New Delhi,1975.

WEB REFERENCES

1. <https://morth.nic.in/national-road-safety-policy-1>
2. <https://openknowledge.worldbank.org/handle/10986/21913>

E-TEXT BOOKS

1. <https://www.india.gov.in/download-e-book-ministry-road-transport-and-highways>
2. <https://www.icevirtuallibrary.com/doi/book/10.1680/mohd.41110>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/106/105106115/>

HIGHWAY MATERIAL CHARACTERIZATION

I M.TECH-I SEMESTER

Course Code: BIHE102PC

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. The main objective of this course is to provide students with a thorough understanding of the important factors in pavement design and analysis.
2. The focus will be on practices of pavement design of highway agencies.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Determine the proportions of ingredients required for the mix design of both asphalt mixtures and cement concrete.
2. Characterize the pavement materials including soil, aggregate, cement, asphalt mixtures, cement concrete.
3. Select appropriate asphalt binder for construction of a flexible pavement depending upon the traffic and climatic conditions.
4. Choose appropriate stabilization technique for pavement.
5. Understand the basic of cement & cement concrete mix characterization.

UNIT-I SUBGRADE SOIL CHARACTERIZATION:

Properties of sub grade layers; different types of soils, Mechanical response of soil; Soil Classification; Index and other basic properties of soil; A critical look at the different laboratory and in-situ procedures for evaluating the mechanical properties of soils viz. SPT, DCPT, CPT, CBR, Plate Load test & resilient modulus; Suitability of different type of soil for the construction of highway embankments and pavement layers; Field compaction and control. Dynamic properties of soil: FWD test.

UNIT -II INTRODUCTION TO SOIL STABILIZATION:

Physical and Chemical modification: Stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen. Grouting: Categories of grouting, Art of grouting, Grout materials, Grouting techniques and control. Introduction to Ground improvement techniques; Introduction to Geo textiles and synthetics applications

UNIT -III AGGREGATE:

Origin, Classification, Types of aggregates; Sampling of aggregates; Mechanical and shape properties of aggregates, Aggregate texture and skid resistance, polishing of aggregates; Proportioning and Blending of aggregates: Super pave gradation, Fuller and Thompson's Equation, 0.45 power maximum density graph; Use of locally available materials in lieu of aggregates.

UNIT -IV BITUMEN AND BITUMINOUS CONCRETE MIX CHARACTERIZATION:

Bitumen sources and manufacturing, Chemistry of bitumen, bitumen structure, Rheology of bitumen, Elastic modulus, Dynamic modulus, visco-elastic and fatigue properties, creep test, stiffness modulus of bitumen mixes using shell nomographs; Resilient, Diametral Resilient and Complex (Dynamic) Moduli of Bituminous Mixes, Permanent Deformation Parameters and other Properties.Modified bitumen: Crumb Rubber Modified bitumen, Natural rubber modified bitumen, polymer modified bitumen; Introduction to super pave mix design procedure.

UNIT -V CEMENT CONCRETE MIX CHARACTERIZATION

Types of cements and basic cement properties, Special cements; Quality tests on cement; Tests on cement concrete including compressive strength, flexural strength, modulus of elasticity and fatigue properties; Introduction to advanced concretes like self-compacted concrete, Light weight concrete, Roller Compacted Concrete for pavement application; IS method of cement concrete mix design with case studies; Role of different admixtures in cement concrete performance; Joint fillers for Jointed Plain Cement Concrete Pavements and their characterization; Nano technology applications in cement concrete.

TEXT BOOKS

1. Highway Engineering-S.K.Khanna,C.E.G.Justo
2. Traffic Engineering and Transport Planning - Kadiyali L.R., Khanna Publishers

REFERENCE BOOKS

1. Atkins, N. Harold, Highway Materials, Soils and Concretes, Fourth Edition, 2002, Prentice-Hall.
2. Kerbs Robert D. and Richard D. Walker, Highway Materials, McGraw-Hill, 1971.
3. Relevant IRC and IS Codes of Practices (Separate List will be given).
4. Read, J. And Whiteoak, D., “The Shell Bitumen Handbook”, Fifth edition, Shell Bitumen, Thomas Telford Publishing, London 2003
5. Relevant IRC and IS codes.

WEB REFERENCES

1. <https://www.coursehero.com/file/26978881/CSE312-Topic-3-Pavement-Material-Characterization>

E-TEXT BOOKS

1. https://sjce.ac.in/wp-content/uploads/2018/01/CV530_05_Pavement-Materials.pdf

MOOCS COURSE

1. <https://www.youtube.com/watch?v=3oNa9Z94Hiw>

EVALUATION OF STRENGTHENING OF PAVEMENTS

I M.TECH-I SEMESTER

Course Code: BIHE103PC

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. Learn the **importance** of evaluation and strengthening of pavements
2. **Explains** the stress and strains for various types of pavements and its evaluation procedures
3. **Reveals** the structural and functional requirements of pavements along with its failures
4. Understands overlay designs **concepts** performed through BBD and FWD

COURSE OUTCOMES

At the end of the course, the student will be able to

1. **Assess** how functional and structural pavements occurs
2. **Understands** different types of distress in pavements
3. **Perform** BBD and FWD test for evaluation of pavements
4. **Explains** the different types of pavement failures

UNIT-I INTRODUCTION

Highway and airport pavements, Types and component parts of pavements, their differences - Factors affecting design and performance of pavements.

UNIT -II STRESSES AND DEFLECTIONS IN FLEXIBLE & RIGID PAVEMENTS:

Stresses and deflections in homogeneous masses. Wheel load stresses, various factors in traffic wheel loads; ESWL and EWL factors. Pavement behavior under transient traffic loads; Factors affecting design and performance of pavements. Types of stresses and causes, factors influencing the stresses; general considerations in rigid pavement analysis, EWL, wheel load stresses, warping stresses, frictional stresses, combined stresses.

UNIT -III STRUCTURAL AND FUNCTIONAL REQUIREMENTS OF FLEXIBLE AND RIGID PAVEMENTS:

Pavement distress; different types of failures & its causes – structural & functional safety – repair and retrofitting of road structures.

UNIT -IV EVALUATION OF SURFACE CONDITION:

Methods of measurement of skid resistance, unevenness, ruts and cracks. Pavement surface condition evaluation by physical measurements, by riding comfort and other methods; their applications.

UNIT -V EVALUATION OF PAVEMENT STRUCTURAL CONDITION:

Evaluation by non-destructive tests such as FWD, Benkelman Beam rebound deflection using BBD for flexible overlay design, Plate load test, wave propagation and other methods of load tests; evaluation by destructive test methods, and specimen testing.

TEXT BOOKS

1. Principles of Pavement Design' by Yoder, E.J., and Witczak, 2nd ed. John Wiley and Sons, 1975.
2. The design and performance of road pavements by Croney, D. and P. Croney, McGraw-Hill Book Company, London, UK, 1991

REFERENCE BOOKS

1. Test Book of Highway Engineering' by Khanna and Justo, Nem chand brothers, Roorkee- 2004.
2. Pavement Management System' by Haas and Hudson McGraw Hill Book Co., New York, 1994.
3. Pavement Design and Materials by Papagiannakis, A.T. and E.A. Masad, John Wiley and Sons, New Jersey, USA, 2008.
4. Pavement Engineering – Principles and Practice by Mallick, R.B. and T. El-Korchi CRC Press, Taylor and Francis Group, Florida, USA, 2009.

WEB REFERENCES

1. <http://pavers.nl/pdf/The%20Required%20Mathematics.pdf>

E-TEXT BOOKS

1. <https://bookslock.org/highway-engineering-s-k-khanna-c-e-g-justo/>
2. <https://learnengineering.in/highway-engineering-books/>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/101/105101087/>

ROAD ENGINEERING
(Professional Elective – I)

I M.TECH-I SEMESTER

Course Code: BIHE101PE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

This course will focus on introducing students to the co relational view on geometrics and land use. The sensitivity of transport systems to road engineering are also dealt.

COURSE OUTCOMES

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

1. Describe the functions and importance of geometric audit
2. Correlate the geometrics with land use
3. Relate the sensitivity of transport systems to road engineering.
4. Understand the land use and traffic sensitivity to infrastructure policies.
5. Understand the applications of Road engineering

UNIT-I HIGHWAY GEOMETRIC AUDIT

Audit process, leads, assumptions on problems defining, audit policies, Highway geometrics, audit interface to different types of roads. Evaluation of audit results.

UNIT –II TRAFFIC CORRELATION VIEW ON GEOMETRICS AND LAND USE

Planning policies on geometrics and Land use. Hierarchical connectivities and land use regulations. Traffic-infrastructure – land use relational correlations. Level of service impact due to mixed traffic on regulated geometrics. Role of traffic management to non-geometric realities of road. Road engineering policies in reference to land use and traffic mobility.

UNIT -III TRANSPORT SYSTEM SENSITIVITY TO ROAD ENGINEERING:

Transport systems like BRTS, MRTS, Transit systems, IPT and cars- its sensitivity in traffic mobility. Road geometrics of static sensitivity to dynamic characteristics of transportation systems. Road engineering policies in reference to transportation systems.

UNIT -IV INTEGRATED LANDUSE AND INFRASTRUCTURE

Geometric sensitivity, landuse sensitivity and traffic sensitivity to infrastructure policy, differentials among landuse and road engineering. Changes of policies over a time and change of land use at integration level. Road engineering measure on reduction of traffic congestion.

UNIT -V APPLICATIONS OF ROAD ENGINEERING

Sensitivity of road development plans across the landuse of CBD, high intensity zones and urban sprawl areas. Geometric stability in reference to safety among different hierarchical roads. Regional, urban and rural roads – leads on road development plans.

TEXT BOOKS

1. Fundamentals of Traffic Engineering, Richardo G Sigua
2. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson.
3. Highway Engineering-S.K.Khanna,C.E.G.Justo

REFERENCE BOOKS

1. Road Safety by NCHRP
2. Metropolitan transportation planning – John W. Dickey, Tata Mc Graw Hill, NewDelhi,1975.

WEB REFERENCES

1. <https://www.britannica.com/technology/road/The-modern-road>

E-TEXT BOOKS

1. deep.iitb.ac.in/webpage_data/nptel/Civil%20Engineering/Transportation%20Engg%20I/11-Ltexhtml/nptel_ceTEI_L11.pdf

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/101/105101087/>
2. <http://rkgitw.ac.in/nptel/105101087/Transportation%20Engg%20I/TOC.htm>

ROAD SAFETY ENGINEERING
(Professional Elective – I)

I M.TECH-I SEMESTER

Course Code: BIHE102PE

L T P C
3 0 0 3

COURSE OBJECTIVES

1. This course discusses the fundamentals of traffic engineering & some of the statistical methods to analyze the traffic safety.
2. The accident investigation and risk involved with measures to identify the causes are dealt.
3. The various traffic management systems for safety & safety improvement strategies are dealt.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. To understand fundamentals of traffic engineering.
2. To investigate & determine the collective factors & remedies of accidents involved.
3. To design & plan road geometrics to improve safety.
4. Role of Urban infrastructure design in safety.
5. To conduct road safety audits.

UNIT-I FUNDAMENTALS OF TRAFFIC ENGINEERING

Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Traffic Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons

UNIT –II ACCIDENT INVESTIGATIONS AND RISK MANAGEMENT:

Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction

UNIT -III ROAD SAFETY IN PLANNING AND GEOMETRIC DESIGN:

Vehicle And Human Characteristics, Road Design and Road Equipments, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care

UNIT -IV ROLE OF URBAN INFRASTRUCTURE DESIGN IN SAFETY:

Geometric Design of Roads; Design of Horizontal and Vertical Elements, Junctions, At Grade and Grade Separated Intersections, Road Safety in Urban Transport, Sustainable Modes and their Safety.

UNIT -V TRAFFIC MANAGEMENT SYSTEMS FOR SAFETY

Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety Improvement Strategies, ITS and Safety.

TEXT BOOKS

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
2. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.
3. Transportation Engineering – An Introduction, C.Jotin khisty, B. Kent Lall

REFERENCE BOOKS

1. Fundamentals of Traffic Engineering, Richardo G Sigua
2. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa,
3. Road Safety by NCHRP

WEB REFERENCES

1. <http://www.jpri.in/services/road-safety-engineering/>

E-TEXT BOOKS

1. <https://www.tiipublications.ie/training/ST13/Road-Safety-Engineering-Update.pdf>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/106/105106115/>

MODELLING FOR HIGHWAY SIMULATION
(Professional Elective – I)

I M.TECH-I SEMESTER

Course Code: BIHE103PE

L T P C
3 0 0 3

COURSE OBJECTIVES

1. The objectives of the course is to introduction concepts of modelling and sensitivity
2. Simulation and its application are dealt.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. The assumptive approach and the minimization and maximization interfaces.
2. The objectives and functions of sensitivity analysis.
3. The concepts of locational and area modelling.
4. Methods of simulation
5. Applications of modelling and simulation

UNIT-I MODELLING IN TRANSPORTATION

Conceptualization, Assumptive approach, constraint, sensitization, limitations, interface, optimization, equalization, Minimization and Maximization interface in relation to transportation issues.

UNIT -II SENSITIVITY ANALYSIS

Changes in constraints, Maximization problems, Minimization problems, change in objectives function, sensitivity analysis

UNIT -III MODELLING FRAMES FOR TRANSPORTATION

Location modelling in common areas, time modelling in reference to transportation, area modelling in reference land use. Fractal interface for smart city modeling, 3rd dimension modelling interface to infrastructure, link stabilization of mobility.

UNIT -IV SIMULATION

Conceptual leads, simulation methods, steps in simulation, simulation of traffic characteristics, case examples.

UNIT -V APPLICATION OF MODELLING & SIMULATION

Traffic signal sensitization, traffic signal synchronization, Highway infrastructure modelling, deterioration of pavement modelling, supportive infrastructure modelling on optimal location.

TEXT BOOKS

1. Fundamental of Traffic Engineering- M Shine & Rogers.
2. Traffic Flow Fundamental by AD may, prentice hall.
3. Highway Engineering-C.E.G.Justo,S.K.Khanna
4. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers.

REFERENCE BOOKS

1. Principles of Highways Engineering and Traffic Analysis - Fred Mannering & Walter Kilareski, John Wiley & Sons Publication.
2. Mathematical programming Mik Wisniewski, Tony Dacre McGraw-Hill

WEB REFERENCES

1. <https://link.springer.com/book/10.1007/978-1-4471-5637-6>

E-TEXT BOOKS

1. https://warwick.ac.uk/fac/cross_fac/complexity/study/emmc/outcomes/studentprojects/tadeusiak.pdf

MOOCS COURSE

1. <https://nptel.ac.in/courses/112/107/112107220/>

PAVEMENT DESIGN & EVALUATION
(Professional Elective – II)

I M.TECH-I SEMESTER
Course Code: BIHE104PE

L T P C
3 0 0 3

COURSE OBJECTIVES

1. Engineering analysis of stresses and strains in typical highway pavement structures due to loading from traffic and climate; characterization of paving materials; structural pavement design by IRC, and AASHTO for flexible and rigid pavement are discussed.
2. Overlay design for Flexible and Rigid pavement is discussed.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Analyze the stresses and strains in a flexible pavement using multi-layered elastic theory.
2. Analyze stresses and strains in a rigid pavement using Westergaard's theory.
3. Design a Flexible pavement using IRC, Asphalt Institute, and AASHTO methods.
4. Design a Rigid pavement using IRC, and AASHTO methods.
5. Design of joints, dowel & tie bars.

UNIT-I FACTORS AFFECTING PAVEMENT DESIGN:

Variables Considered in Pavement Design, Types of Pavements, Functions of Individual Layers, Classification of Axle Types of Rigid Chassis and Articulated Commercial Vehicles, Legal Axle and Gross Weights on Single and Multiple Units, Tire Pressure, Contact Pressure, EAL and ESWL Concepts, Traffic Analysis: ADT, AADT, Truck Factor, Growth Factor, Lane Distributions & Vehicle Damage Factors, Effect of Transient & Moving Loads.

UNIT -II STRESSES IN FLEXIBLE PAVEMENT:

Vehicle-Pavement Interaction: Transient, Random & Damping Vibrations, Steady State of Vibration, Experiments on Vibration, Stress Inducing Factors in Flexible and Rigid pavements; Stress In Flexible Pavements: Visco-Elastic Theory and Assumptions, Layered Systems Concepts, Stress Solutions for One, Two and Three Layered Systems, Fundamental Design Concepts.

UNIT -III PARKING ANALYSIS AND TRAFFIC SAFETY:

Westergaard's Theory and Assumptions, Stresses due to Curling, Stresses and Deflections due to Loading, Frictional Stresses, and Stresses in Dowel Bars & Tie Bars.

UNIT -IV DESIGN OF FLEXIBLE PAVEMENTS:

Factors effecting Design. Deflection studies in Flexible Pavements. Present Serviceability Index. IRC guidelines for Flexible Pavements. Pavement Performance and methods- AASHTO and Asphalt Institute Method.

Need for Overlays, Overlays design methods for Flexible and Rigid pavements

UNIT -V DESIGN OF RIGID PAVEMENTS:

Factors effecting Design - Wheel load & its repetition, subgrade strength & proportion, strength of concrete-modulus of elasticity. Reinforcement in slab. Design of joints. Design of Dowel bars. Design of Tie bars. IRC and AASHTO methods of Rigid Pavement design.

TEXT BOOKS

2. Design of Functional Pavements, Nai C. Yang, McGraw Hill Publications.
3. Concrete Pavements, AF Stock, Elsevier, Applied Science Publishers.
4. Highway Engineering-S.K.Khanna,C.E.G.Justo

REFERENCE BOOKS

1. Principles of Pavement Design, Yoder.J. & Witzorac Mathew, W. John Wiley & Sons Inc.
2. Pavement Analysis & Design, Yang H. Huang, Prentice Hall Inc.
3. Pavement and Surfacing for Highway & Airports, Micheal Sargious, Applied Science Publishers Limited.
4. IRC: 37 & 58 Codes for Flexible and Rigid Pavements Design.

WEB REFERENCES

1. <https://www.equip-global.com/pavement-design-and-evaluation-live-online-event>

E-TEXT BOOKS

1. <https://easyengineering.net/pavement-analysis-and-design-book-pdf/>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/104/105104098/>

RURAL ROADS
(Professional Elective – II)

I M.TECH-I SEMESTER

Course Code: BIHE105PE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. This course focuses on planning of rural roads as well as design of pavements.
2. Various specifications for construction of rural roads is discussed
3. The importance of quality control construction and maintenance of rural roads is discussed

COURSE OUTCOMES

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

1. Understand the concepts of planning and alignment of rural road networks.
2. Gain knowledge of the materials and pavement design for rural roads.
3. Understand the construction and specifications for rural roads.
4. Understand the importance of waste materials for pavement construction.
5. Understand the importance of quality control in construction and maintenance of rural roads.

UNIT-I PLANNING AND ALIGNMENT

Planning of Rural Roads, Concept of Network planning, rural roads planning, road alignment and surveys, governing factors on route selection, factors considered for alignment.

UNIT -II MATERIALS AND PAVEMENT DESIGN

Introduction, Soil ,material surveys, embankment and subgrade materials, stabilized Soils, Road aggregates, aggregate for base courses, new materials as stabilizers, materials for desert areas, materials for bituminous constructions and surfacing; materials for rigid pavements, special pavement, climatic suitability of concrete materials. Introduction, design procedure, pavement components, design of flexible and rigid pavements, special pavements design, types of drainage, and general criteria for road drainage, system of drainage, surface and subsurface systems.

UNIT -III CONSTRUCTION AND SPECIFICATIONS

Introduction, selection of materials and Methodology, Embankment and subgrade, sub – base (granular), base (granular), shoulder, bituminous concrete, semi- rigid pavements, construction, concrete pavements, construction of special pavements, equipment required for different procedures.

UNIT -IV WASTE MATERIAL FOR PAVEMENT CONSTRUCTION

Introduction, fly ash for road construction, design & construction, design & construction of fly ash embankment lime fly ash and stabilized soil, lime fly ash pavements, control of compaction, concrete stabilized fly ash with admixtures.

UNIT -V QUALITY CONTROL IN CONSTRUCTION AND MAINTENANCE

Introduction, Pre-requirements, organizational setup, specification and code of practice, Laboratory equipment, Earth and granular layers, bituminous courses, semi- rigid and rigid pavements, special requirements, recovered of quality control data. Distresses/Defects in rigid and flexible pavements, Maintenance and evaluation, inventory roads and inspections, types of Maintenance Activities, Maintenance.

TEXT BOOKS

1. HMSO, Soil Mechanics for rural Engineers in, London
2. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson.
3. Highway Engineering-S.K.Khanna,C.E.G.Justo

REFERENCE BOOKS

1. Road Safety by NCHRP
2. IRC manual for rural roads. Special publication – 20(2002)
3. HMSO, Soil Mechanics for rural Engineers in, London
4. IRC related code books
5. NRRDA – guidelines and code books

WEB REFERENCES

1. <https://pmgsy.nic.in/planning-rural-roads>
2. <https://www.sciencedirect.com/topics/engineering/rural-roads>

E-TEXT BOOKS

1. https://tnrd.gov.in/buildings_design/Roads_Bridges.pdf

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/101/105101087/>

TRAFFIC ENGINEERING
(Professional Elective –II)

I M.TECH-I SEMESTER
Course Code: BIHE106PE

L T P C
3 0 0 3

COURSE OBJECTIVES

1. This module focuses on traffic, its properties, measurement, simulation and control. It deals with traffic flow variables and their measurement. Survey methods and data analysis techniques required by traffic engineers are presented.
2. Introduction to highway capacity & level of service is dealt.
3. Parking analysis, traffic safety, traffic signal control, regulation, signal design is discussed.
4. Detrimental effects of traffic on environment, Air and Noise pollution are discussed.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Understand Basic traffic Characteristics
2. Understand the importance of capacity and LOS
3. Analyze design issues related to parking & traffic signal
4. To know the good understanding of Traffic Control, Regulation Signal Coordination:
5. Understand the detrimental effect of traffic on environment.

UNIT-I TRAFFIC CHARACTERISTICS MEASUREMENT AND ANALYSIS:

Basic traffic Characteristics - Speed, Volume and Concentration. Relationship between Flow, Speed and Concentration. Traffic Measurement and Analysis - Volume Studies - Objectives, Methods; Speed studies – Objectives, Definition of Spot Speed, time mean speed and space mean speed; Methods of conducting speed studies; Presentation of speed study data; Head ways and Gaps; Critical Gap; Gap acceptance studies.

UNIT -II HIGHWAY CAPACITY AND LEVEL OF SERVICE:

Basic definitions related to capacity; Level of service concept; Factors affecting capacity and level of service; Computation of capacity and level of service for two lane highways, Multilane highways and freeways

UNIT -III PARKING ANALYSIS AND TRAFFIC SAFETY:

Types of parking facilities – On-street parking and Off-street Parking facilities; Parking studies and analysis- Parking Inventory Study, Parking Usage Study By Patrolling, Questionnaire Survey, Cordon Surveys; Evaluation of parking parameters; Parking accumulation, Parking Load, Parking Turnover, Parking Index, Parking Volume. Traffic Safety - Accident studies and analysis; Causes of accidents - The Road, The vehicle, The road user and the Environment; Engineering, Enforcement and Education measures for the prevention of accidents.

UNIT –IV TRAFFIC CONTROL, REGULATION SIGNAL COORDINATION:

Traffic Signals –Types of Signals; Principles of Phasing; Timing Diagram; Design of Isolated Traffic Signal by Webster method, Warrants for signalization. Signal Coordination - Signal Co-ordination methods, Simultaneous, Alternate, Simple progression and Flexible progression Systems.

UNIT –V TRAFFIC AND ENVIRONMENT:

Detrimental effects of Traffic on Environment, Air pollution; Noise Pollution; Measures to curtail environmental degradation due to traffic. Sustainable Transportation: Sustainable modes, Transit Oriented Development, ITS based benefits for Environment.

TEXT BOOKS

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers.
2. Traffic Engineering - Theory & Practice - Louis J.Pignataro, Prentice Hall Publication.

REFERENCE BOOKS

1. Principles of Highways Engineering and Traffic Analysis - Fred Mannering & Walter Kilareski, John Wiley & Sons Publication.
2. Transportation Engineering - An Introduction - C.Jotin Khisty, Prentice Hall Publication
3. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.
4. I.T.E. Traffic Engineering Hand Book.

WEB REFERENCES

1. <https://nacto.org/wp-content/uploads/2012/06/ITE-2009.pdf>
2. <https://www.sciencedirect.com/topics/computer-science/traffic-analysis>

E-TEXT BOOKS

1. <https://easyengineering.net/traffic-engineering-and-management-local-author/>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/101/105101008/>

PAVEMENT MATERIALS LAB

I M.TECH- I SEMESTER

Course Code: BIHE104PC

L T P C
0 0 3 1.5

COURSE OBJECTIVES:

The course should enable the students to:

1. Objective material characterization of aggregates.
2. Fundamental tests on Bitumen

COURSE OUTCOMES:

By the end of the course students will be able:

1. Characterize the pavement materials.
2. Perform quality control tests on pavements and pavement materials.
3. Conduct test on Aggregate & bitumen

LIST OF EXPERIMENTS

Aggregate

Experiment-1	Crushing Strength
Experiment-2	Impact test
Experiment-3	Shape tests Sieve analysis on Fine & Coarse aggregate (Gradation for different Layers in highway)
Experiment-4	Los Angeles Abrasion Test
Experiment-5	Specific gravity & Water absorption Test

Bitumen

Experiment-6	Penetration test
Experiment-7	Softening point test
Experiment-8	Ductility test
Experiment-9	Flash & Fire point test
Experiment-10	Specific gravity test
Experiment-11	Viscosity Test
Experiment-12	Marshall Stability Mix Design

REFERENCE BOOKS:

1. Highway Engineering – S.K. Khanna & C.E.G. Justo. New Chand & Brothers.
2. Highway material Testing - S.K. Khanna & C.E.G. Justo.
3. IRC: SP: 19; 2001, Manual For Survey, Investigation & Preparation of Road Projects

WEB REFERENCES:

1. <https://www.coursehero.com/file/30818239/Highway-lab-experimentsdocx/>

TRAFFIC ANALYSIS LAB

I M.TECH- I SEMESTER

Course Code: BIHE105PC

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

The course should enable the students to:

1. Analyzing characteristics of traffic
2. Various parameter related to delay, speeds and headways

COURSE OUTCOMES:

By the end of the course students will be able:

1. Gain Knowledge about various traffic surveys
2. Analyze traffic parameters for various studies

LIST OF EXPERIMENTS

Experiment-1	Classified Volume counts
Experiment-2	Spot Speeds
Experiment-3	Gap Acceptance
Experiment-4	Headway-space & time mean
Experiment-5	Delay studies
Experiment-6	Volume-capacity-Competency for different highways
Experiment-7	Lane discipline and its impact
Experiment-8	Vehicle- Road-Median-clave impact analysis

REFERENCE BOOKS:

1. Highway Engineering – S.K. Khanna & C.E.G. Justo. New Chand & Brothers.
2. Highway material Testing - S.K. Khanna & C.E.G. Justo.
3. IRC: SP: 19; 2001, Manual For Survey, Investigation & Preparation of Road Projects

WEB REFERENCES:

1. <https://dl.acm.org/doi/10.1145/1298306.1298310>
2. <https://www.coursehero.com/file/30818239/Highway-lab-experimentsdocx/>

ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course - I)

I M.TECH-I SEMESTER

Course Code: BIHE101AC

L	T	P	C
2	0	0	0

COURSE OBJECTIVES

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section

COURSE OUTCOMES

Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT-I PLANNING AND PREPARATION

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT -II PARAPHRASING AND PLAGIARISM, SECTIONS OF A PAPER

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT -III REVIEW OF THE LITERATURE

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT -IV KEY SKILLS-I

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT -V KEY SKILLS-II

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

TEXT BOOKS

1. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
2. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

REFERENCE BOOKS

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

WEB REFERENCES

1. <https://www.springer.com/gp/book/9783319260921>

E-TEXT BOOKS

1. <http://tiramisutes.github.io/images/PDF/English+for+Writing+Research+Papers.pdf>

MOOCS COURSE

1. <https://nptel.ac.in/courses/110/105/110105091/>

RESEARCH METHODOLOGY AND IPR
(Audit Course - I)

I M.TECH-I SEMESTER

Course Code: BIHE102AC

L T P C
2 0 0 0

COURSE OBJECTIVES

1. To understand the research problem
2. To know the literature studies, plagiarism and ethics
3. To get the knowledge about technical writing
4. To analyze the nature of intellectual property rights and new developments
5. To know the patent rights

COURSE OUTCOMES

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

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT-I MEANING OF RESEARCH PROBLEM

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT -II EFFECTIVE LITERATURE STUDIES

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT -III EFFECTIVE TECHNICAL WRITING

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT -IV NATURE OF INTELLECTUAL PROPERTY

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT -V PATENT RIGHTS

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

TEXT BOOKS

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

REFERENCE BOOKS

1. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”
2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.
3. Mayall, “Industrial Design”, McGraw Hill, 1992.
4. Niebel, “Product Design”, McGraw Hill, 1974.
5. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

WEB REFERENCES

1. <http://svpcet.org/research-methodology-and-intellectual-property-rights-18mc0101/>
2. <https://www.enago.com/academy/intellectual-property-rights-what-researchers-need-to-know/>

E-TEXT BOOKS

1. <https://iare.ac.in/sites/default/files/MTECH-CAD.CAM-R18-RM-IP-NOTES.pdf>

MOOCS COURSE

1. https://onlinecourses.nptel.ac.in/noc19_ge21/preview
2. <https://nptel.ac.in/courses/110/105/110105139/>

I-YEAR (II-SEMESTER)

TRAFFIC ANALYSIS

I M.TECH-II SEMESTER

Course Code: BIHE201PC

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. This module focuses on traffic, its properties, measurement, simulation and control.
2. Traffic flow variables and their measurement. Traffic flow and queuing theory is introduced. Survey methods and data analysis techniques required by traffic engineers are presented.
3. Analysis of pedestrian delays and warrants.

COURSE OUTCOMES

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

1. Estimate basic characteristics of traffic stream.
2. Conduct traffic studies and analyze traffic data.
3. Understand traffic queue system.
4. Understand the pedestrian delays & gaps. Understand simulation techniques

UNIT-I TRAFFIC FLOW DESCRIPTION:

Traffic Stream Characteristics and Description Using Distributions: Measurement, Microscopic and Macroscopic Study of Traffic Stream Characteristics - Flow, Speed and Concentration; Use of Counting, Interval and Translated Distributions for Describing Vehicle Arrivals, Headways, Speeds, Gaps and Lags.

UNIT -II TRAFFIC STREAM MODELS:

Traffic Stream Models: Fundamental Equation of Traffic Flow, Speed-Flow-Concentration Relationships, Normalized Relationship, Fluid Flow Analogy Approach, Shock Wave Theory - Flow-Density diagram use in Shockwave analysis; Use of Time-space diagram for shockwave description; Bottleneck situations and shockwaves; traffic signal and shockwave theory; numerical Examples for application of shockwave theory; Car-Following Theory.

UNIT -III QUEUING ANALYSIS:

Fundamentals of Queuing Theory, Demand Service Characteristics, Deterministic Queuing Models, Stochastic Queuing Models, Multiple Service Channels, Analysis of M/M/1 system; Assumptions and Derivation of System State Equations; Application of M/M/1 analysis for parking Garages and Toll Plazas- numerical Examples; Analysis of D/D/1 system for delay characteristics; Traffic Signal analysis as D/D/1 system.

UNIT -IV PEDESTRIAN DELAYS AND GAPS:

Pedestrian Gap acceptance and delays; Concept of Blocks, Anti- blocks, Gaps and Non-Gaps; Underwood's analysis for Pedestrian Delays; Warrants for Pedestrian Crossing Facilities – Minimum Vehicular Volume Warrant, Minimum Pedestrian Volume Warrant, Maximum Pedestrian Volume Warrant.

UNIT -V SIMULATION OF TRAFFIC:

Introduction, Advantages of Simulation techniques, Steps in Simulation, Scanning techniques, Example of Simulation.

TEXT BOOKS

1. Traffic Flow Theory: A Monograph, TRB Special Report 165.
2. Highway Engineering-S.K.Khanna,C.E.G.Justo
3. Fundamentals of Transportation Engineering – C.S. Papacostas, Prentice Hall India Publication

REFERENCE BOOKS

1. Principles of Highway Engineering and Traffic Analysis – F.L. Mannering & W.P. Kilareski, John Wiley Publishers.
2. Traffic Flow Fundamentals – A.D. May, Prentice Hall India Publication
3. Fundamentals of Traffic Engineering – McShane & Rogers,1977.

WEB REFERENCES

1. <https://www.sciencedirect.com/topics/computer-science/traffic-analysis>

E-TEXT BOOKS

1. <http://www.civilittee-hu.com/uploads/1/Traffic/book5th.pdf>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/101/105101008/>

LAND USE & TRANSPORT MODELING

L	T	P	C
3	0	0	3

I M.TECH-II SEMESTER

Course Code: BIHE202PC

COURSE OBJECTIVES

1. This course covers the fundamentals of land use theory.
2. Various land use and travel demand models are discussed.
3. Concepts of network planning and advanced spatial analysis are discussed.

COURSE OUTCOMES

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

1. Understand the fundamentals of land use theory.
2. Apply land use theories for urban region development.
3. Apply evolving understanding of development to provide a collaborative, interactive & applied environment for development.
4. Develop travel demand models.

UNIT-I LAND USE AND TRANSPORTATION ENGINEERING

Transportation modeling in Planning; Models and their role, Characteristics of Transport demand and supply, Equilibrium of supply and demand, Modeling and decision making, Issues in Transportation modeling and structure of the classic transport model.

UNIT -II LAND USE TRANSPORTATION AND ACTIVITY MODEL

Introduction to Land Use Planning; Relation between Transportation and Land Use Planning; The economic base mechanism and allocation mechanism; Spatial allocation and employment interrelationship; Garin Lowry models.; Activity modeling.

UNIT -III GENERAL TRAVEL DEMAND MODELS AND REGIONAL TRANSPORT MODELS

Aggregate, Disaggregate models; Behavioral models; Recursive and direct demand Models; Linear, Non-Linear models; Logit, discriminant and probit models; Mode split models - Abstract mode and mode specific models. Regional Transport Models: Factors affecting goods and passenger traffic; Prediction of traffic; Growth factor models; Time function iteration models; internal volume forecasting models.

UNIT -IV REGIONAL NETWORK PLANNING

Problems in Developing Countries, Network Characteristics - Circuitry, Connectivity, Mobility, Accessibility and Level of Service Concepts - Network Structures and Indices – Network Planning – Evaluation - Graph Theory – Cut sets – Flows & Traversing – Optimum Network - Inter-modal Co-ordination. – Rural Road Network Planning.; User equilibrium concepts:

UNIT –V APPLICATIONS OF ARTIFICIAL NEURAL NETWORKS

Applications of Artificial Neural networks, Cellular automata, Fuzzy logic systems, Genetic algorithms, artificial intelligence concepts to transportation Modelling.

TEXT BOOKS

1. Modelling Transport by Jhan De Dios Ortuzar. Luis E. Willumsen. John Wiley& Sons. 1970/1975.
2. Urban Development Models - Ed. By R. Baxter, M. Echenique and J.Owers; The Institute of Transportation Engineering, University of California.
3. Economic Models and Economic Forecast - Robert S, Pindyek, Daniel L. Rubin Field; McGraw Hill.

REFERENCE BOOKS

1. Land Use Transportation Planning Notes - S.R.Chari, REC Warangal.
2. Regional and Urban Models- A.G.Wilson; Pion, London.
3. Urban Modeling - Michael Batty.
4. Behavioral Travel Demand Models - Peter R. Stopher ARNIM.H. MEYBURG.
5. Introduction to Transportation Engineering and Planning, Morlok EK, McGraw Hill.

WEB REFERENCES

1. <https://www.wiley.com/en-us/Modelling+Transport%2C+4th+Edition-p-9780470760390>

E-TEXT BOOKS

1. <https://download.e-bookshelf.de/download/0000/5967/64/L-G-0000596764-0002364278.pdf>
2. [https://edisciplinas.usp.br/pluginfile.php/5781766/mod_resource/content/0/Ortuzar% 20andWillum sen Modelling% 20Transport.pdf](https://edisciplinas.usp.br/pluginfile.php/5781766/mod_resource/content/0/Ortuzar%20andWillum%20sen%20Modelling%20Transport.pdf)

MOOCS COURSE

1. <https://nptel.ac.in/courses/124/105/124105016/>
2. <https://nptel.ac.in/courses/105/108/105108073/>

ADVANCED CONCRETE TECHNOLOGY

I M.TECH-II SEMESTER

Course Code: BIHE203PC

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. **Adopt the correct** type of cement to suit the particular requirements depending on exposure conditions.
2. **Design** economic concrete mix proportion for the given exposure conditions and with the available materials, to the extent possible for the desired strength.
3. **Address** various problems that arise during concreting operations.
4. **Judge and resolve** any controversy that arises regarding material suitability confidently by substantiating through field and laboratory tests.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. **Determine** the properties of concrete ingredients i.e. cement, sand, coarse aggregate by conducting different tests and decide the suitability.
2. **Recognize** the effects of the rheology and early age properties of concrete on its long- term behavior.
3. Use **appropriate** chemical admixtures and mineral additives for achieving the desired properties.
4. Use **advanced** laboratory techniques to assess the strength characteristics after disasters

UNIT-I CONCRETE MAKING MATERIALS:

Cement – Bogue’s compounds –Hydration process - Types of cement –Aggregates-Gradation curves- Combined aggregates-Alkali silica reaction–Admixtures- mineral and chemical admixtures.

UNIT -II FRESH AND HARDENED CONCRETE:

Fresh concrete-workability tests on concrete–setting times of fresh concrete- segregation and bleeding.

Hardened Concrete: Abram's law – Gel- space ratio - maturity concept –stress strain behavior- creep and shrinkage-durability of concrete-Non-destructive testing of concrete. Introduction to XRD & SEM Analysis.

UNIT -III HIGH STRENGTH CONCRETE:

Microstructure-manufacturing and properties--ultra high strength concrete. High performance concrete- Requirements and properties of high performance concrete-design considerations.

UNIT -IV SPECIAL CONCRETES:

Light weight concrete-Self Compacting concrete-Polymer concrete -Fiber reinforced concrete –Reactive powder concrete-Bacterial concrete-Geo-polymer concrete – Requirements and guidelines- Advantages and Applications – Porous pavement – White Topping– Roller compacted concrete.

UNIT -V CONCRETE MIX DESIGN:

Quality control –Quality assurance-Quality audit-Mix design by various methods-BIS method-DOE method-ACI method - Erntroy& Shacklock’s method.

TEXT BOOKS

1. Concrete Technology by M.L. Gambhir, McGraw Hill Education (India) Pvt. Ltd,5th edition
2. Concrete Technology by M.S. Shetty,S. Chand& Co.

REFERENCE BOOKS

1. Concrete technology by A.M. Neville & J J Brooks, Low price edition 2004, Pearson Education.
2. Concrete –Microstructure, properties and materials by P. Kumar Mehta & Paulo J.M. Monteiro- 3rd edition published by Tata Mc Graw Hill Education Pvt. Ltd.
3. Properties of concrete by A.M. Neville, Pearson publishers,
4. Design of Concrete Mixes by N. Krishna Raju, CBS Publications.

WEB REFERENCES

1. <https://www.sciencedirect.com/book/9780750656863/advanced-concrete-technology>

E-TEXT BOOKS

1. <http://kec.edu.np/wp-content/uploads/2017/06/Advanced-Concrete-Technology.pdf>
2. <https://www.elsevier.com/books/advanced-concrete-technology-1/newman/978-0-08-048998-8>

MOOCS COURSE

1. https://onlinecourses.nptel.ac.in/noc20_ce45/preview

PROJECT FORMULATION AND ECONOMICS
(Professional Elective – III)

I M.TECH-II SEMESTER

Course Code: BIHE207PE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The student needs to

2. Understand the need & scope of project formulation.
3. Learn evaluation of economics of highway projects.
4. Understand the concepts of economic analysis and shadow pricing
5. Learn to deal with project analysis and environmental impact assessment

COURSE OUTCOMES

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

1. Understand project formulations & project evaluation.
2. Analysis the feasibility of highway projects.
3. Demonstrate the need for environmental impact assessment.

UNIT-I PROJECT FORMULATION

Project Preparation – Flow Chart for Project preparation. Project Cycle- Project Formulation – Need and Scope of Project Formulation – Various Aspects and Approaches in Project Formulation. Stages in Project Formulation. Preparation of Feasibility Report and DPR – Guidelines.

UNIT -II ECONOMIC EVALUATION

Need for Economic Evaluation; Stages involved in Economic Analysis; Cost and Benefit components; Discounting Criteria; Welfare economics; Social costs; Rate of Return; Road User Cost study in India; Value of Travel time Savings – Economic concept of evaluation of travel time savings; Issues connected with evaluation of travel time savings. Vehicle operating costs – Components of VOC, Accident costs; Methodologies for economic evaluation of an accident.

UNIT -III ECONOMIC ANALYSIS

Basic Concepts of Economic Analysis, Principles of Economic Analysis; Cash flow diagrams; Time value of Money; Development of cash flow Diagrams; Methods of Economic Evaluation –Equivalent Uniform Annual Cost Method; Present worth of cost method; - Equivalent uniform annual net return method; Net present value method; Benefit cost ratio method; Rate of Return Method. Applications of these methods to highway projects.

UNIT -IV PROJECT APPRAISAL BY SHADOW PRICING WITH CASE STUDIES:

Toll system analysis, Financial analysis; Budgeting.

UNIT -V ENVIRONMENTAL IMPACT ASSESSMENT

Basic Concepts, Objectives, Transportation Related Environmental Impacts – Vehicular Impacts – Safety and Capacity Impacts – Roadway Impacts – Construction Impacts, Environmental Impact Assessment – Environmental Impact Statement, Environment Audit, Typical case studies.

TEXT BOOKS

1. Transportation Engineering Economics – Heggie. I. G.; Mc Graw Hill Publishers.
2. Economic Analysis for Highways – Winfrey.R; International TextBook Company.
3. Traffic Engineering and Transport Planning – L.R Kadiyali, Khanna Publishers.

REFERENCE BOOKS

1. Road User Cost Study, CRRI
2. Road Project Appraisal, for Developing Countries, J.W.Dickey ,John Wiley & Sons.
3. IRC: SP: 19; 2001, Manual For Survey, Investigation & Preparation of Road Projects.
4. IRC: SP: 30, Manual on Economic Evaluation of Highway Projects in India.

WEB REFERENCES

1. <http://www.fao.org/3/a0323e/a0323e01.htm>
2. <https://www.adb.org/documents/guidelines-economic-analysis-projects>

E-TEXT BOOKS

1. <https://www.freebookcentre.net/business-books-download/Project-Planning,-Analysis-and-Management.html>

MOOCS COURSE

1. <https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-me35/>

INTELLIGENT TRANSPORTATION SYSTEMS
(Professional Elective – III)

I M.TECH-II SEMESTER

Course Code: BIHE208PE

L T P C
3 0 0 3

COURSE OBJECTIVES

This course will focus on introducing students about intelligent Transport Systems in transportation engineering. Students successfully completing this course should be able to:

1. Understand the purposes of ITS and the kinds of problems to which ITS is applied.
2. Understand the fundamental types of ITS data
3. Use ITS operators to perform a number of kinds of analysis.
4. Be prepared to use ITS to support free Traffic movement.

COURSE OUTCOMES

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

1. Describe the Basic Principles of ITS.
2. Understand the concepts of ITS and its applications.
3. Understand the Advanced Traffic management system Analysis.
4. Apply ITS for various transportation issues

UNIT-I

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.

UNIT-II

Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System

UNIT-III

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).

UNIT-IV

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.

UNIT-V

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.

TEXT BOOKS

1. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
2. Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.
3. National ITS Architecture Documentation, US Department of Transportation, 2007 (CD-ROM).

REFERENCE BOOKS

2. Fundamentals of Intelligent Transportation Systems Planning, Mashrur A. Chowdhury, Adel Sadek. Artech house publishers. U.S. 2003.
3. Intelligent Transportation systems standards, Bob William's, Artech House inc. London. 2008.
4. Pradeep kumar sarkar, Amit kumar Jain, PHI learning, 2008.
5. Traffic Engineering, R.P. Roess, SE Prassas and WR Mcshane, Artech house Inc. US. 2003.

WEB REFERENCES:

1. <https://court.iitm.ac.in>
2. <https://www.iitp.ac.in>
3. <https://www.iitb.ac.in>

NPTEL:

1. <https://nptel.ac.in>

REMOTE SENSING & GIS
(Professional Elective – III)

I M.TECH-IISEMESTER

Course Code: BIHE209PE

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COURSE OBJECTIVES

This course will focus on introducing students to the use of Geographic Information Systems in the urban environment for transportation engineering. Students successfully completing this course should be able to:

1. Understand the purposes of GIS and the kinds of problems to which GIS is applied.
2. Understand the fundamental types of GIS data, including raster and vector data.
3. Be able to explain and perform spatial data retrieval tasks.
4. Use GIS operators to perform a number of kinds of analysis.
5. Be prepared to use GIS to support personal and professional decision making.
6. Be aware of Geographic Information that is available on the World Wide Web.
7. Understand the limitations of Geographic Information systems and of geographic data in general.

COURSE OUTCOMES

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

1. Describe the Basic Principles of Remote Sensing.
2. Understand the concepts of Pre-Processing of Remotely Sensed Data and its applications.
3. Understand the data processing, Analysis and Modeling techniques.
4. Apply GIS for various transportation issues
5. Apply GIS in environment impact assessment

UNIT-I REMOTE SENSING:

Basic Principles – Introduction, Electromagnetic and its properties, interaction with Earth surface materials, recent developments in Remote sensing, Social and legal implications of Remote sensing, status of Remote sensing, Characteristics of Imaging remote sensing instruments, satellite remote sensing system – a brief over view, other remote sensing satellites.

UNIT -II PRE-PROCESSING OF REMOTELY SENSED DATA:

Introduction, cosmetic operation; Geometric connection and registration, atmospheric correction.

Image Transforms: Introduction, arithmetic operations, empirically based image transforms, principal component analysis, multiple discriminant analysis etc

UNIT -III GIS INTRODUCTION DATA PROCESSING, ANALYSIS AND MODELING:

Raster based GIS data processing – vector based GIS data processing – Queries – Spatial analysis – Descriptive statistics – Spatial autocorrelation – Quadrant counts and nearest neighbor analysis – Network analysis – surface modeling – DTM; Data Management : The data base designs and approaches, 3 classic data models, nature of geographic data, spatial data models, Databases for GIS; Definitions of GIS – Components of GIS – Geographic data presentation : maps – mapping process – Coordinate systems – Transformations-map projections – geo referencing – data acquisition.

UNIT -IV APPLICATION OF GIS IN TRANSPORTATION ENGINEERING – I:

Intelligent information system for road accessibility study, GIS data base design for physical facility planning, Decision support systems for land use planning.

UNIT -V APPLICATION OF GIS IN TRANSPORTATION ENGINEERING – II:

GIS applications in environment impact assessment and environment monitoring, GIS based Highway alignment, GIS based road network planning, GIS based traffic congestion analysis and accident investigation, Utility management.

TEXT BOOKS

2. Lo, C.P. & Yeung A.K.W., Concepts and Techniques of Geographic Information Systems, Prentice Hall of India, New Delhi, 2002.
3. Burrough, P.A., Principles of Geographical Information Systems, Oxford Publication, 1998.
4. Clarke, K., Getting Started with Geographic Information Systems, Prentice Hall, New Jersey, 2001.
5. DeMers, M.N., Fundamentals of Geographic Information Systems, John Wiley & Sons, New York, 2000.

REFERENCE BOOKS

1. Geo Information Systems – Applications of GIS and Related Spatial Information Technologies, ASTER Publication Co., Chestern (England), 1992.
2. Jeffrey, S. & John E., Geographical Information System – An Introduction Prentice – Hall, 1990.
3. Marble, D.F., Galkhs HW & Pequest, Basic Readings in Geographic Information Systems, Sped System Ltd., New York, 1984.
4. GIS for Urban & Regional Planning, Scholten & Stillwen 1990, Kulwer Academic
5. GIS A management, Perspenfi Stan Aronoff, WDL Publisher
6. GIS By Stonffer

WEB REFERENCES

1. <https://www.tandfonline.com/doi/abs/10.1080/1365881031000111173>

E-TEXT BOOKS

1. <https://nptel.ac.in/content/storage2/courses/105108073/module1/lecture1.pdf>
2. <https://easyengineering.net/text-book-of-remote-sensing-and-geographical-information-systems-by-anji-reddy/>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/108/105108077/>
2. <https://nptel.ac.in/courses/105/103/105103193/>

PAVEMENT CONSTRUCTION & MAINTENANCE
(Professional Elective – IV)

I M.TECH-II SEMESTER

Course Code: BIHE210PE

L T P C
3 0 0 3

COURSE OBJECTIVES

1. Being able to recognize and use current pavement design procedures.
2. Understanding common design and construction features important to the performance of both asphalt and concrete pavements.
3. The ability to design and recognize specification and construction activities that can improve the performance of pavements.
4. Evaluating the condition of pavements through surface condition surveys, smoothness, friction, load/deflection and other evaluation techniques.
5. Understanding the basic components of pavement management systems and how they can be used to optimize funding expenditures

COURSE OUTCOMES

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

1. Understand the concepts of PMS and evaluate strategies for pavement maintenance.
2. Evaluate the pavements based on the functional and structural characteristics.
3. Understand constructions of Construction methods of Base, Subbase, Shoulders and drains.
4. Understand constructions of bituminous pavements.
5. Understand the concepts of construction and maintenance of cement concrete pavements.

UNIT-I PAVEMENT MANAGEMENT SYSTEM

Components of PMS and their activities; Major steps in implementing PMS; Inputs; Design, Construction and Maintenance; Rehabilitation and Feedback systems; Examples of HDM and RTIM packages; Highway financing; Fund generation; Evaluating alternate strategies and Decision criteria ; Pavement Maintenance Management Components of Maintenance Management and Related Activities – Network and Project Level Analysis; Prioritization Techniques and Formulation of Maintenance Strategies.

UNIT -II PAVEMENT INVENTORIES, QUALITY CONTROL AND EVALUATION

Serviceability Concepts; Visual Rating; Pavement Serviceability Index; Roughness Measurements; Distress Modes – Cracking Rutting Etc; Pavement Deflection – Different Methods and BBD, Skid Resistance, Roughness, Safety – Aspects; Inventory System. Causes of Deterioration, Traffic and Environmental Factors, Pavement Performance Modeling Approaches and Methods of Maintaining WBM, Bitumen and Cement Concrete Roads, Quality Assurance; Quality Control – ISO 9000, Sampling Techniques – Tolerances and Controls related to Profile and Compaction.

UNIT -III CONSTRUCTION OF BASE, SUBBASE, SHOULDERS AND DRAIN

Roadway and Drain Excavation, Excavation and Blasting, Embankment Construction, Construction of Gravel Base, Cement Stabilised Sub- Bases, WBM Bases, Wet Mix Construction; Crushed Cement Bases, Shoulder Construction; Drainage Surface, Turfing Sand Drains; Sand Wicks; Rope Drains, Geo- Textile Drainage; Preloading Techniques

UNIT -IV BITUMINOUS CONSTRUCTION AND MAINTENANCE

Preparation and Laying of Tack Coat; Bituminous Macadam, Penetration Macadam, Built up Spray Grout, Open Graded Premix, Mix Seal, Semi-Dense Asphalt Concrete-Interface Treatments and Overlay Construction, IRC Specifications.

UNIT -V CEMENT CONCRETE PAVEMENT CONSTRUCTION AND MAINTENANCE

Cement Concrete Pavement Analysis - Construction of Cement Roads, Manual and Mechanical Methods, Joints in Concrete and Reinforced Concrete Pavement and Overlay Construction.

TEXT BOOKS

1. Bridge and Pavement maintenance- Transportation Research Record no.800, TRB.
2. Haas and Hudson, W. R. Pavement management systems –McGraw Hill publications.
3. Highway Engineering-S.K.Khanna,C.E.G.Justo

REFERENCE BOOKS

1. Sargious, M. A. – Pavements and surfacing for highways and airports – Applied Science Publishers ltd.
2. Shahin M.Y, 1994- Pavement management for airports, roads and parking lots.
3. Bent Thagesan, 1996- Highway and Traffic engineering for developing countries.
4. MORTH - Specifications.

WEB REFERENCES

1. <https://www.sgs.com/en/construction/services-related-to-materials/road-construction-services>

E-TEXT BOOKS

1. <https://www.fhwa.dot.gov/construction/pubs/ots15002.pdf>
2. [https://www.nijc.org/pdfs/TTAP/BIA/82%20IAM_Handbook%20%20BIA%20Road%20Maintenance%20Program%20minimized%20\(1\).pdf](https://www.nijc.org/pdfs/TTAP/BIA/82%20IAM_Handbook%20%20BIA%20Road%20Maintenance%20Program%20minimized%20(1).pdf)

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/104/105104098/>
2. <https://nptel.ac.in/courses/105/101/105101087/>

**ROAD SAFETY AND SUPPORTING INFRASTRUCTURE
EVALUATION
(Professional Elective – IV)**

I M.TECH-II SEMESTER

Course Code: BIHE211PE

L T P C
3 0 0 3

COURSE OBJECTIVES

1. The importance of role of culverts and islands for improved safety
2. Traffic violations and its sensitivity is also dealt
3. Land use policies and its impact on road safety is dealt.

COURSE OUTCOMES

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

1. Role of supportive infrastructure and its importance
2. The concepts of geometric compatibility
3. The impact of vehicle mobility on road safety
4. The various LU policies and their importance
5. Risk mobility on road.

UNIT-I ROLE OF CULVERTS & STORM WATER DRAINS

Supportive Infrastructure role, access patterns to mobilize water into roads, catchment area computations along these roads. Flood water assessment to design storm water draining. Location analysis on culverts per Km of road.

UNIT -II ROLE OF ISLANDS AND ITS SAFETY

Threat to common area, dynamics at intersection, geometric compatibility units, vehicular speeds, island simulated view of vehicles. Size, shape and orientation of islands and its compatibility to mobility.

UNIT -III TRAFFIC VIOLATIONS AND ITS SENSITIVITY ON ROAD SAFETY:

Traffic characteristic impact on vehicle mobility, impact over speed, violation of lane discipline on safety. Driver emotion, perception on road safety, Vehicle- land use – driver sensitivity to road safety.

UNIT -IV LAND USE POLICES & VIOLATION AND ITS IMPACT ON ROAD SAFETY

Land use forms and orientation. Activity potentiality and land use geometric speed, policy sensitivity and its violation in urban areas. Land use impact on supportive infrastructure and road right of way

UNIT -V APPLICATION OF RISK MOBILITY ON ROAD

Computation of risk generation, risk distribution, risk convergence, way out to release risk into control devices, monitoring, ITS interface, geometric and land use controls to mitigate risk.

TEXT BOOKS

1. Highway Engineering-S.K.Khanna,C.E.G.Justo
2. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers.
3. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.

REFERENCE BOOKS

1. Coppola DP, 2007 Introduction to International Disaster Management, Elsevier Science (B/4) London.
2. Manual on Natural Disaster Management in India, MC Gupta NIDM, New Delhi.

WEB REFERENCES

1. <https://roadsafety.piarc.org/en/planning-design-operation-monitoring-and-evaluation/evaluating-interventions>
2. <https://www.sciencedirect.com/science/article/pii/S235214651630309X>

E-TEXT BOOKS

1. https://www.researchgate.net/publication/304530315_Safety_PLA_Support_Tool_for_Road_Safety_Impact_Assessment

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/106/105106115/>

TRANSPORTATION SYSTEMS MANAGEMENT
(Professional Elective – IV)

I M.TECH-II SEMESTER

Course Code: BIHE212PE

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COURSE OBJECTIVES

1. Discuss systems approach of transportation planning
2. Discuss various principle of transit vehicles, their differing operating environments and how they affect urban street design.
3. Describe bus route networks and issues in route evaluation
4. Discuss measure to promote non-auto modes
5. Study the characteristics of advanced transit technology

COURSE OUTCOMES

1. At the end of the course, students will be able to
2. Understand TSM, the need for TSM and the objectives of TSM.
3. Understand the types of TSM strategies.
4. Recommend methods to manage a transit system to improve its management efficiency.
5. Understand the concepts of bus route networks and issues in route evaluation
6. Understand the importance of non-auto modes and advanced transit technology

UNIT-I TSM PHILOSOPHY

System approach to Transportation Planning; Long Term Strategies and Short Term Measures; TSM actions- Objectives and Philosophy; Relevance of TSM actions Indian Urban context. Board Spectrum of TSM actions. Measures for Improving vehicular flow – one way Streets, Signal Improvement, Transit Stop Relocation, Parking Management, Reversible lanes- Reducing Peak Period Traffic - Strategies for working hours, Congestion Pricing, Differential Toll Policies.

UNIT -II MEASURES TO PROMOTE TRANSIT

Measures to promote transit: Preferential Treatment to high Occupancy Vehicles; Car Polling; Transit Service Improvement Measures; Transit Management Improvement Measure; Transit and Para transit integration; Para Transit Role in urban areas; Multi-Modal Coordination.

UNIT -III BUS ROUTE NETWORK PLANNING AND MANAGEMENT

Type of Bus Route Networks; Suitability for a given Urban Area; Types of routes – Corridor routes, activity routes and residential routes; issues in route networks evaluation – number of route, length of route; route alignment methods; service coverage and accessibility index.

UNIT -IV PROMOTION OF NON – AUTO MODES

Measures to promote non-auto modes; Pedestrianisation; Bicycle Transportation - advantages; Planning Bicycle Facilities - class I, Class II and Class III bikeways; Junction Treats for cycle tracks; LOS criteria for Pedestrian and bicycle Facilities

UNIT -V ADVANCED TRANSIT TECHNOLOGIES

Conventional and Unconventional Systems; Rapid Transportation System; New technologies – LRT, monorail, Automated Highways- Hovercraft; System Characteristics and Suitability

TEXT BOOKS

1. Highway Engineering-S.K.Khanna,C.E.G.Justo
2. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers.
3. Metropolitan Transportation Planning, John W Dickey, Tata McGraw Hill

REFERENCE BOOKS

1. Transportation System management Notes: S.R.Chari, REC Warangal
2. Metropolitan Transportation Planning, John W Dickey, Tata McGraw Hill
3. The Bicycle Planning, Mike Hudson , Open Books, UK

WEB REFERENCES

1. <https://ops.fhwa.dot.gov/tsmo/>
2. <http://www.transportationefficient.org/implement-transportation-system-management/>

E-TEXT BOOKS

1. <https://onlinelibrary.wiley.com/doi/10.1002/9781119174660.ch10>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/101/105101087/>

PAVEMENT EVALUATION AND PERFORMANCE LAB

I M.TECH- II SEMESTER

Course Code: BIHE204PC

L T P C
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COURSE OBJECTIVES:

The course should enable the students to:

1. The various assessment techniques of the pavement
2. The mix design of pavement
3. Visual analysis and other pavement characteristics

COURSE OUTCOMES:

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

1. Design and assess various pavement components
2. Analyze pavement failures and their characteristics

LIST OF EXPERIMENTS

Experiment-1	Mix Design of Pavement
Experiment-2	Deflection Assessment on Pavement
Experiment-3	Density Assessment on Pavement
Experiment-4	Surface Condition Assessment
Experiment-5	Visual Condition Analysis of Pavement
Experiment-6	Pavement Failure-Analysis
Experiment-7	Impact of Road Geometric on Skid Resistance
Experiment-8	Material and Deficient Pavement Layers and its Impact on Pavement Performance.

REFERENCE BOOKS:

1. Highway Engineering – S.K. Khanna & C.E.G. Justo. New Chand & Brothers.
2. Highway material Testing - S.K. Khanna & C.E.G. Justo.
3. IRC: SP: 19; 2001, Manual For Survey, Investigation & Preparation of Road Projects

WEB REFERENCES:

1. https://www.researchgate.net/publication/316205412_Laboratory_evaluation_of_pavement_performance_using_modified_asphalt_mixture_with_a_new_composite_reinforcing_material
2. <https://www.crridom.gov.in/content/pavement-evaluation>

PAVEMENT DESIGN LAB

I M.TECH- II SEMESTER

Course Code: BIHE205PC

L T P C
0 0 3 1.5

COURSE OBJECTIVES:

1. This course of Open Road aims to help you excel various features of the software, such as Interoperable Database that means creation and annotation of 3D project models.
2. It will also help you to learn digital terrain model creation and integration with Google Earth.
3. It will also help you to learn Terrain Modeling
4. This course of Start For Open Roads Designer Drawing Production
5. To know the Open Roads Designer

COURSE OUTCOMES:

1. The student will able to learn the rapid and accurate design of all types of road designs.
2. It contributes to improving the quality of designs by combining traditional engineering workflow profile and cross sections with 3D modeling technology
3. It contributes to improving the quality of designs by Corridor Modelling & Super elevation
4. The student will able to learn the Corridor Modelling Quantities
5. The student will able to learn the Start For Open Roads Design Geometry

LIST OF EXPERIMENTS

Experiment-1	Introduction to Open Roads Design
Experiment-2	Terrain Modelling
Experiment-3	Start for Roads Design Geometry
Experiment-4	Corridor Modelling Quantities
Experiment-5	Corridor Modelling & Super elevation
Experiment-6	Start for Roads Design Drawing Production

WEB REFERENCES:

1. https://ifsacademy.org/bentley-openroads-onlinetraining/?gclid=Cj0KCQjwsLWDBhCmAR IsAPSL3_1IRHEnM CGTtRz5vIXdxL2DNIFVrfWCljzThe2sbdprwA6X03Th0mIaAloJEALw_wcB
2. <https://docs.bentley.com/LiveContent/web/OpenRoads%20Designer%20CONNECT-v6/en/GUID-591B264A-98E3-4DD8-BBE5-57862169ED54.html>
3. <https://www.tn.gov/tdot/roadway-design/tdot-cadd-support/tdot-openroads-designer/ord-tutorial-videos/openroads-designer-fundamentals.html>

MOOCS COURSE

1. <https://www.youtube.com/channel/UCSqfsFesjMSKXgMUEF77bLg>

DISASTER MANAGEMENT
(Audit Course-II)

I M.TECH-II SEMESTER
Course Code: BIHE203AC

L T P C
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COURSE OBJECTIVES

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches,
5. Planning and programming in different countries, particularly their home country or the countries they work in

COURSE OUTCOMES

At the end of the course, the student will be able to

1. the application of Disaster Concepts to Management
2. Analyzing Relationship between Development and Disasters.
3. Ability to understand Categories of Disasters and
4. realization of the responsibilities to society

UNIT-I TRAFFIC CHARACTERISTICS MEASUREMENT AND ANALYSIS:

Introduction:

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Disaster Prone Areas in India:

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT -II REPERCUSSIONS OF DISASTERS AND HAZARDS

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT -III DISASTER PREPAREDNESS AND MANAGEMENT:

Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT -IV RISK ASSESSMENT DISASTER RISK:

Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT -V DISASTER MITIGATION

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

TEXT BOOKS

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.),” Disaster Mitigation Experiences and Reflections”, Prentice Hall of India, New Delhi.

REFERENCE BOOKS

1. Goel S. L., Disaster Administration and Management Text and Case Studies”, Deep &Deep Publication Pvt. Ltd., New Delhi.
2. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
3. National Disaster Management Plan, Ministry of Home affairs, Government of India(<http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf>)

WEB REFERENCES

1. <https://github.com/topics/disaster-management>
2. <https://www.emeraldgroupublishing.com/journal/dpm>
3. [file:///C:/Users/CIVIL-2/Downloads/activity-547-1%20\(1\).pdf](file:///C:/Users/CIVIL-2/Downloads/activity-547-1%20(1).pdf)

E-TEXT BOOKS

1. <http://rcueslucknow.org/publication/TrainingModules/Dr.A.K.Singh/HandBookDisasterManagement.pdf>
2. https://content.kopykitab.com/ebooks/2016/06/7327/sample/sample_7327.pdf
3. <https://easyengineering.net/disaster-management-handbook-by-jack-pinkowski/>
4. <https://www.smartzworld.com/notes/disaster-management-pdf-notes-dm/>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/104/105104183/>
2. <https://www.classcentral.com/course/disasterprep-481>

**PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTMENT
SKILLS
(Audit Course-II)**

I M.TECH-II SEMESTER

Course Code: BIHE204AC

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PREREQUISITE: None

COURSE OBJECTIVES:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

COURSE OUTCOMES: Students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

UNIT-I:

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT-II:

Neetisatakam-Holistic development of personality

- Verses- 52,53,59 (don't's)
- Verses- 71,73,75,78 (do's)

UNIT-III:

Approach to day to day work and duties.

- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-IV:

Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:

- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

TEXT BOOKS/ REFERENCES:

1. “Srimad Bhagavad Gita” by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

II-YEAR (I-SEMESTER)

BRIDGE ENGINEERING
(Professional Elective – V)

II M.TECH-I SEMESTER

Course Code: BIHE313PE

L T P C
3 0 0 3

COURSE OBJECTIVES

The objective of the course is to introduce the concepts in bridge design. the analysis of bridge decks and sub structure are also dealt with.

COURSE OUTCOMES

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

1. The method of design of concrete bridges
2. Design of solid slab and continuous bridges
3. Basic principles and design of prestressed bridges
4. Analysis of bridge decks
5. Design loads of abutments and piers.

UNIT-I CONCRETE BRIDGES

Introduction-Types of Bridges-Economic span length-Types of loading-Dead load- live load-Impact Effect-Centrifugal force-wind loads-Lateral Loads-Longitudinal forces-Seismic loads- Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.

UNIT -II SOLID SLAB, GIRDER BRIDGES & CONTINUOUS BRIDGES

Introduction-Method of Design. Girder Bridges - Introduction-Method of Design-Courbon's Theory. Continuous Bridges - Introduction- Span lengths- Analysis of Continuous Bridges-Decking of Girders with constant Moment of Inertia-Continuous bridges with variable Moment of Inertia-Method of Analysis -Girders with Parabolic Soffit-Method of plotting Influence lines-Girders with Straight Haunches-Design steps for Continuous Bridges.

UNIT -III PRE-STRESSED CONCRETE BRIDGES

Basic principals- Method of Pre-stressing-Pretensioning and Post- tensioning- Comparison- Freyssinet Method-Magnel-Blanet System-Lee-Mc call system-Basic Assumptions-Losses in Prestress-Equation based on Initial and final stress conditions-Cable Zone- Design of selections-Condition of first crack- Ultimate load design-Shear-Vertical Prestressing- Diagonal Tension in I-section-End Block-Magnel's method-Empirical Method-General Design requirements-Mild steel reinforcement in prestressed concrete member

UNIT -IV ANALYSIS OF BRIDGE DECKS

Analysis of Bridge Decks: Harmonic analysis and folded plate theory-Grillage analogy- Finite strip method and FEM. Concrete cover and spacing of pre-stressing steel-Slender beams-Composite Section-Propped-Design of Propped Composite Section-Unpropped composite section-Two-stage Prestressing-Shrinking stresses-General Design requirements for Road Bridges.

UNIT -V SUB-STRUCTURE OF BRIDGES

Sub-structure of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers- Abutments- Design loads for Abutments

TEXT BOOKS

1. Design of Concrete Bridges by M.G. Aswani, V.N. Vazirani and M.M. Ratwani.

REFERENCE BOOKS

1. Bridge Deck Behaviour by E.C. Hambly.
2. Concrete Bridge Design and Practice by V.K.Raina.

WEB REFERENCES

1. <https://www.bridgeweb.com>
2. <https://ascelibrary.org/journal/jbenf2>

E-TEXT BOOKS

1. <https://cdn.bkfd4.club/r/w68GsX/?q=bridge%20deck%20behaviour%20second%20edition%20by%20e%20c%20hambly%20pdf>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/105/105105165/>

HIGHWAY INFRASTRUCTURE DESIGN
(Professional Elective – V)

II M.TECH-I SEMESTER

Course Code: BIHE314PE

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3	0	0	3

COURSE OBJECTIVES

1. Students will develop a good command of the concepts involved in geometric design of intersections, horizontal & vertical alignment of roads & pedestrian facilities.
2. Describe the urban street hierarchy and functional classification system.
3. Identify and define the elements of a roadway cross-section. Discuss concepts related to the roadway design speed.
4. Discuss alignment and grade elements including sight distance; horizontal and vertical curves; terrain and acceptance grades for urban local and collector streets.
5. Define the functional area of an intersection. Identify key design elements for intersections.
6. Identify pedestrian street crossing issues.

COURSE OUTCOMES

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

1. Design the longitudinal and cross-sectional elements of a highway.
2. Design the horizontal and vertical alignment of roads.
3. Design the intersections, interchanges, and parking facilities.
4. Design the facilities for bicyclists and pedestrians.

UNIT-I FUNCTIONAL CLASSIFICATION OF HIGHWAY SYSTEM:

Design Controls – Topography, Driver characteristics, Vehicle Characteristics, Traffic, Capacity and Level of Service, Design Speed. Objectives of Geometric Design, Cross Section Elements: Design specifications; Pavement Surface characteristics

– Skid Resistance, Road Roughness; Camber, Objectives, design standards. Specifications for hill roads.

UNIT -II HORIZONTAL ALIGNMENT OF ROADS

Sight Distances – Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance; Objectives of horizontal curves; Super elevation; Extra- widening on Curves; Transition Curves – Objectives and Design. Transition Curve setting methods.

UNIT -III VERTICAL ALIGNMENT OF ROADS

Gradients – Types of Gradients, Design Standards; Vertical Curves – Summit Curves, Valley Curves and Design criteria for Vertical Curves; Importance of Sight Distances for Horizontal and Vertical Curves; Combination of Vertical and Horizontal Curves – Grade Compensation

UNIT -IV GEOMETRIC DESIGN OF INTERSECTIONS

Geometric Design of Intersections: Types of Intersections; Design Principles for Intersections; Design of At-grade Intersections – Channelization, Objectives; Traffic Islands and Design standards; Rotary Intersection – Concept, Advantages and Disadvantages; Grade separated Interchanges – Types, warrants and Design standards

UNIT -V MISCELLANEOUS ELEMENTS

Requirements of Pedestrians; Pedestrian facilities on Urban Roads; Cycle Tracks – Guidelines and Design standards; Bus bays –Types and Guide lines; Design of On-street and Off-street Parking facilities – Guidelines for lay out Design, Traffic Signs and Markings.

TEXT BOOKS

1. Highway Engineering-S.K.Khanna,C.E.G.Justo
2. Fundamentals of Transportation Engineering – C.S. Papacostas, Prentice Hall India Publication

REFERENCE BOOKS

1. Principles and Practice of Highway Engineering, L.R. Kadiyali and N.B.Lal, Khanna, 2007.
2. Traffic Engineering and Transportation Planning, L.R.Kadiyali, Khanna Publications, 2007.
3. Highway Engineering, C.E.G.Justo and S.K.Khanna, Nem Chand and Brothers.
4. IRC Codes for Signs, Markings and Mixed Traffic Control in Urban Areas

WEB REFERENCES

1. <https://www.hindawi.com/journals/complexity/2018/5160417/>

E-TEXT BOOKS

1. http://civilcafe.weebly.com/uploads/2/8/9/8/28985467/the_handbook_of_highway_engineering.pdf
2. <https://easyengineering.net/highway-engineering-book-pdf-by-martin/>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/101/105101087/>
2. <https://nptel.ac.in/courses/105/105/105105107/>
3. <https://nptel.ac.in/courses/105/106/105106115/>

URBAN TRANSPORT ECONOMICS PLANNING
(Professional Elective – V)

II M.TECH-I SEMESTER

Course Code: BIHE315PE

L T P C
3 0 0 3

COURSE OBJECTIVES

1. Providing a solid introduction to transportation demand and cost analysis.
2. Finding specific transportation mode, but will use the various modes to apply the theoretical and analytical concepts presented in the lectures and readings.
3. Key principles governing transportation planning, investment, operations and maintenance. It introduces the macroeconomic concepts central to transportation systems.

COURSE OUTCOMES: At the end of the course, students will be able to

1. Understanding the issues & challenges in the Transportation Sector
2. To develop skills required for Transport planning & formulation.
3. Understand optimization techniques for Transport Planning & Pricing.
4. Analysing the processes for Transport project execution and control.
5. Demonstrating contracting process as applied in Transport projects.

UNIT-I TRANSPORT ECONOMICS:

Introduction to Transport Economics, Economic Theory, Demand & Supply issues, Related policies and Management issues, Transport Elasticity

UNIT -II TRIP GENERATION

Trip Generation, Trip Distribution, Modal Split Analysis, Route Assignment, Transportation System Analysis

UNIT -III TRANSPORT DEVELOPMENT:

Policy initiatives by central and state Governments, JnNURM Phase 1 & 2, AMRUT, UMTA, NUTP 2006, National Transport Development Policy Committee

UNIT -IV ANALYSIS ON TRANSPORT COST:

Direct and External costs of Transport, Congestion Cost & Pricing, External cost, Social Aspects of Transport, Peak Load Pricing, and Marginal cost pricing rule, Subsidy, Price discrimination.

UNIT -V TRANSPORT PLANNING:

Methods of Benchmarking performance, Feasibility and Evaluation, GIS Applications, Cost Benefit Analysis, Contracts in Transportation, DPR preparation

TEXT BOOKS

1. Prathiba Deshmukh (2010) – Urban Transport Planning And Management SBS Publishers and Distributors Pvt Ltd
2. Dr. Ashish Verma and T. V. Ramanayya (2014) – Public Transport Planning and Management in Developing Countries, CRC Press; 1st edition (23 December 2014)

REFERENCE BOOKS

1. Report on Indian Urban Infrastructure and Services.
2. The Economics of Urban Transportation by Kenneth A. Small & Erik T. Verhoef.
3. HANDBOOK ON SERVICE LEVEL BENCHMARKING

**GIS & IOT FOR PLANNING & POLICY MAKING FOR SMART
CITIES/URBAN AREAS
(Open Elective)**

II M.TECH-I SEMESTER
Course Code: BIHE301OE

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3	0	0	3

COURSE OBJECTIVES:

The course should enable the students to:

1. Introduction and vision of IoT.
2. Use of IoT for smart cities along with GIS.
3. Various levels of IoT and its advantages.

COURSE OUTCOMES

At the end of the course the student should be able to:

1. At the end of the course, students will be able to Understand
2. The importance of National and International policies for smart cities
3. Applications of with GIS for urban cities.
4. Applications of IoT for smart cities
5. The concepts of GIS and IoT at analytics level.
6. Applications of IoT and GIS to reduce congestion and pollution in urban cities

UNIT-I SMART CITIES

Urban cities-development, Transportation polices, Smart City configurations with reference to land use and Infrastructure, international policies on Urban cities development, National policies, Problems in urban areas of developing countries and developed countries.

UNIT -II GIS FOR URBAN CITIES

GIS- types of architectures-features for spatial planning and spectral planning, application of GIS for time and space-based planning, GIS for land use, GIS for infrastructure and supportive infrastructure in design and planning.

UNIT -III IOT FOR SMART CITIES

Introduction, communication systems, Local server design for data transfer, central servers design for data analytics, sensor and communication system to address various problems in urban cities.

UNIT –IV GIS AND IOT AT ANALYTICS LEVEL:

GIS for spatial analytics, IOT for spectral characteristics of urban problem in reference to pollution, security, congestion, accident risk and urban floods - different versions and features of open source GIS.

UNIT-V APPLICATIONS OF IOT & GIS

Urban Congestion and Mapping, pollution of water and air and measuring, risk of travel and advanced alert systems, urban floods and technology interface, 3rd dimension mapping and IOT interface, supportive infrastructure and smart city conversions. Case studies on World class cities.

TEXT BOOKS:

1. Lo, C.P. & Yeung A.K.W., Concepts and Techniques of Geographic Information Systems, Prentice Hall of India, New Delhi, 2002.
2. Burrough, P.A., Principles of Geographical Information Systems, Oxford Publication, 1998.

REFERENCE BOOKS:

1. Vijay Madiseti and Ashdeep banga “Internet of Things (a handson approach) 1st edn, VPT, 2014
2. Jan holter, Vlasios Tsiatsis Catherine mulligan, david boyle “From machine to machine to the Internet of things. Introduction to new age. Intelligence, 1st edition, academic press, 2014

WEB REFERENCES:

1. <https://www.esri.in/esri-news/publication/vol9-issue1/articles/gis-for-smart-cities>
2. <https://www.tandfonline.com/doi/full/10.1080/13658816.2019.1673397>

E-TEXT BOOKS:

1. <http://mediabooksharing.top/?download=013149502X>
2. https://www.academia.edu/16045087/Geographic_Information_Systems_GIS_Techniques_Applications_and_Technologies

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/107/105107155/https://nptel.ac.in/courses/107/105/107105088/https://nptel.ac.in/courses/105/103/105103193/>

DISASTER MANAGEMENT
(Open Elective)

II M.TECH-I SEMESTER

Course Code: BIHE302OE

L T P C
3 0 0 3

COURSE OBJECTIVES

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches,
5. Planning and programming in different countries, particularly their home country or the countries they work in

COURSE OUTCOMES

At the end of the course, the student will be able to

1. the application of Disaster Concepts to Management
2. Analyzing Relationship between Development and Disasters.
3. Ability to understand Categories of Disasters and
4. realization of the responsibilities to society

UNIT-I TRAFFIC CHARACTERISTICS MEASUREMENT AND ANALYSIS:

Introduction:

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Disaster Prone Areas in India:

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT -II REPERCUSSIONS OF DISASTERS AND HAZARDS

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT -III DISASTER PREPAREDNESS AND MANAGEMENT:

Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT -IV RISK ASSESSMENT DISASTER RISK:

Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT -V DISASTER MITIGATION

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

TEXT BOOKS

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.),” Disaster Mitigation Experiences and Reflections”, Prentice Hall of India, New Delhi.

REFERENCE BOOKS

1. Goel S. L., Disaster Administration and Management Text and Case Studies”, Deep &Deep Publication Pvt. Ltd., New Delhi.
2. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
3. National Disaster Management Plan, Ministry of Home affairs, Government of India(<http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf>)

WEB REFERENCES

1. <https://github.com/topics/disaster-management>
2. <https://www.emeraldgrouppublishing.com/journal/dpm>
3. [file:///C:/Users/CIVIL-2/Downloads/activity-547-1%20\(1\).pdf](file:///C:/Users/CIVIL-2/Downloads/activity-547-1%20(1).pdf)

E-TEXT BOOKS

1. <http://rcueslucknow.org/publication/TrainingModules/Dr.A.K.Singh/HandBookDisasterManagement.pdf>
2. https://content.kopykitab.com/ebooks/2016/06/7327/sample/sample_7327.pdf
3. <https://easyengineering.net/disaster-management-handbook-by-jack-pinkowski/>
4. <https://www.smartzworld.com/notes/disaster-management-pdf-notes-dm/>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/104/105104183/>
2. <https://www.classcentral.com/course/disasterprep-481>

CONSTRUCTION MANAGEMENT
(Open Elective)

II M.TECH-I SEMESTER

Course Code: BIHE303OE

L T P C
3 0 0 3

COURSE OBJECTIVES

The objective of this course is:

1. To introduce to the student the concept of project management including network drawing and monitoring
2. To introduce various equipments like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery, related to construction.
3. To introduce the importance of safety in construction projects

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to:

1. Appreciate the importance of construction planning
2. Understand the functioning of various earth moving equipment
3. Know the methods of production of aggregate products and concreting and usage of machinery required for the works.
4. Apply the gained knowledge to project management and construction techniques
5. Understand safety practices in construction industry
6. Prepare tender and contract document for a construction project

UNIT-I CONSTRUCTION EQUIPMENT

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers

UNIT -II CONSTRUCTION METHODS

Planning of construction facilities - Earthwork construction - Equipment for construction, Construction Finances – decision making, Cement concrete construction- Construction of Piles - Construction of Cofferdams - Construction of Tunnels

UNIT -III MANAGEMENT

Management -Fundamentals of construction project management: Introduction, Project Initiation and Planning.

UNIT -IV DEVELOPMENT OF PROJECT ACTIVITY NETWORKS

Development of project activity networks, Precedence Diagram Method, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Line Balance Methods in scheduling, Time Value of Money, Investment Analysis, Cost-Benefit Analysis.

UNIT -V CONTRACTS

Contracts: Contracts in construction, fundamentals of delay analysis and claims; Advances in construction management, tender and tender document - Deposits by the contractor - Arbitration. Negotiation - M. Book - Muster roll –stores.

TEXT BOOKS

1. Construction Planning Equipment and Methods, Peurifoy and Schexnayder , Shapira, Tata Mcgrawhill
2. Construction Project Management Theory and Practice, Kumar Neeraj Jha (2011), Pearson.
3. Construction Technology, Subir K. Sarkar and Subhajit Saraswati, Oxford University press.
4. Project Planning and Control with PERT and CPM, B. C. Punamia and K K Khandelwal, Laxmi Publications Pvt Ltd. Hyderabad.

REFERENCE BOOKS

1. Bennett, F. Lawrence., The management of construction: a project life cycle approach. Rutledge, 2003.
2. Oberlender, Garold D., Project management for engineering and construction. Vol. 2. New York: McGraw-Hill, 1993.
3. Peurifoy, Robert Leroy, Cliff J. Schexnayder and Shapira A. Construction planning, equipment, and methods. No. 696 pp. McGraw-Hill, 2010.
4. Chitkara, K. K. Construction Project Management. Tata McGraw-Hill Education, 2014..

WEB REFERENCES

1. <https://libguides.reading.ac.uk/construction/websites>
2. <https://www.tandfonline.com/toc/tjcm20/current>
3. <https://www.journals.elsevier.com/international-journal-of-project-management>

E-TEXT BOOKS

1. https://easyengineering.net/construction-management-books_18/
2. <https://www.engineeringbookspdf.com/civil-engineering/construction-management/>

MOOCS COURSE

1. <https://nptel.ac.in/courses/105/104/105104161/>
2. https://onlinecourses.nptel.ac.in/noc19_ce29/preview

INDUSTRIAL SAFETY
(Open Elective)

II M.TECH- I SEMESTER

Course Code: BIHE304OE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The course should enable the students to:

1. To provide information regarding different elements of industrial water pollution and Methods of treatment.
2. To expose to the various industrial applications, maintenance, preventive measures taken against wear and tear.

COURSE OUTCOMES

At the end of the course the student should be able to:

1. Know how to take safety measures in executing works
2. Identify the need for maintenance (or) replacement of equipment
3. Understand the need for periodic and preventive maintenance

UNIT-I INDUSTRIAL SAFETY

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT -II FUNDAMENTALS OF MAINTENANCE ENGINEERING

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT -III WEAR AND CORROSION AND THEIR PREVENTION

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications. Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT -IV FAULT TRACING:

Fault tracing-concept and importance decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's.

UNIT-V PERIODIC AND PREVENTIVE MAINTENANCE

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: Machine tools,Pumps,Air compressors,Program and schedule of preventive maintenance of mechanical and electrical equipment, Advantages of preventive maintenance. Repair cycle concept and importance

TEXT BOOKS:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.

REFERENCE BOOKS:

1. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
2. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London

WEB REFERENCES:

1. <http://www.nifsindia.net/>

E-TEXT BOOKS:

1. <https://vietnamwcm.files.wordpress.com/2008/08/maintenance-engineering-handbook.pdf>
2. <http://wp.an.edu/cgi-bin/content/view.php?q=s+chand+maintenance+engineering+and+management&filetype=pdf&id=d41d8cd98f00b204e9800998ecf8427e>

MOOCS COURSE

1. <https://nptel.ac.in/courses/110/105/110105094/>
2. https://onlinecourses.nptel.ac.in/noc20_mg43/preview