DEPARTMENT OF CIVIL ENGINEERING

CURRICULUM AND SYLLABUS

Under CBCS
(Applicable for Students admitted from Academic Year 2018-19)

M.Tech (HIGHWAY ENGINEERING)
DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF BUILDING SCIENCES
HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE

INSTITUTION MOTTO, VISION, MISSION AND VALUE STATEMENT

MOTTO
To Make Every Man a Success and No Man a Failure.”

VISION
To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

MISSION
- To create an ecosystem for learning and world class research.
- To nurture a sense of creativity and innovation.
- To instill highest ethical standards and values with a sense of professionalism.
- To take up activities for the development of Society.
- To develop national and international collaboration and strategic partnership with industry and institutes of excellence.
- To enable graduates to become future leaders and innovators.

VALUE STATEMENT
- Integrity, Innovation, Internationalization.

DEPARTMENT OF CIVIL ENGINEERING

VISION:
To be a globally competent Premier Academic Centre for quality education and research in the diverse areas of Civil Engineering with social commitment.

MISSION
M1. To inculcate comprehensive principles to produce highly competent and technologically capable professional engineers, academicians and entrepreneurs.

M2. To impart quality education with strong emphasis on social commitment and sustainability, with ethical standards.

M3. To provide a scholastic environment for state-of-the-art research.

M4. To conduct Knowledge transfer programs to enhance technical knowledge.
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DEPARTMENT OF CIVIL ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: The graduates will become experts in Planning, Designing and executing any infrastructural Development project.

PEO 2: The Graduates will be able to learn and adopt new technologies evolving in the field of Civil Engineering.

PEO 3: The Graduates will become globally competent Civil Engineering Professionals.

PROGRAM OUTCOMES (POs)

On completion of this Program students will be able to:

PO1 Practice as a Structural engineer globally and develop efficiency to integrate existing and new knowledge for enhancement.

PO2 Critically analyze structural problems, take decisions based on information analysis, predict shortfalls and carryout research to provide solutions.

PO3 Identify complex engineering problems, derive compatible solutions and decide upon optimal solution considering socio-Techno-economic factors.

PO4 Develop problem statement through literature review and experimentation, apply research methodology knowledge, tools and techniques in the broad perspective and contribute in team to solve multidisciplinary problems.

PO5 Acquire and Apply modern engineering tools, techniques and softwares to complex structural problems with understanding of limitations.

PO6 Demonstrate team spirit and extend positive support in multidisciplinary research to achieve common goal with enhancement in self and team learning.

PO7 Apply ethical practices and principles to a project and lead the team for efficient project management considering economical and financial factors.

PO8 Communicate with all stakeholders in the desired forms, write and present reports and work done with ability to justify.

PO9 Recognize the need and acquire ability to engage in lifelong learning with commitment, through independent learning and corrective measures.

PO10 Demonstrate professionalism as a structural engineer by adopting ethics, social responsibility and understanding of impact of the judgment/practice on sustainable development of society.
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PO11 Observe and examine critically the projects with commitment, through independent learning and corrective measures.

PROGRAM SPECIFIC OUTCOMES: (PSOs)

The Graduates will be able to

PSO 1: Apply mathematical and basic science knowledge to analyse, and interpret societal problems pertaining to civil engineering.

PSO 2: Exhibit ability to design a system, component or a process in various domains of civil engineering such as structural, environmental and transportation Engineering.
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Academic Regulations for
M. Tech Degree Programmes
(Effective from Academic Year 2018-19)

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I. PREAMBLE
In the context of challenges and opportunities in National development, Post Graduate Education and Research in Engineering, Technology and Architecture has gained distinct importance. The knowledge, skills and competency of engineers and Architects required by industry for enhancing their competitiveness in the market need to be developed from post graduate education and research in engineering, technology and Architecture. Hence the focus is fixed to design and develop a curriculum at PG level in the light of fast changing technological advancement, new emerging areas, changes in pedagogy and delivery system in teaching and learning process.

The full time PG course is spread over two years in four semesters and inclusion of mini project, audit courses, MOOC, open electives and dissertation are the special features of the curriculum. With the rules and regulations laid down for the academic curriculum, the students with advance knowledge and special skills would be able to offer innovative ideas, technology, product and process in national development process and fulfill their career goals.

II. PRELIMINARY DEFINITIONS AND NOMENCLATURE
In these Regulations, unless the context otherwise requires:

1. “Programme” means, Degree Programme like M.Tech. / M.Plan. and M. Arch (Executive) Degree Programme.

2. “Discipline” means, specialization or branch of M.Tech. / M.Plan. and M. Arch (Executive)Degree Programme

3. “Course” means, a theory or practical subject that is normally studied in a semester.

4. “Vice – Chancellor of HITS” means, the Head of the Institution.

5. “Registrar” is the head of all general Administration of the Institute.

6. “Dean Academics” means, the authority of the University who is responsible for all academic activities of various programmes and implementation of relevant rules and Regulations pertaining to the Academic Programmes.

7. “Dean (PGS)” means, the authority of the University who is responsible for all PG (Engg. /Architecture/Planning) programmes and implementation of relevant rules of these Regulations pertaining to the PG Academic Programmes.

8. “Controller of Examinations (CoE)” means, the authority of the University who is responsible for all
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activities related to the University Examinations, publication of results, award of grade sheets and degrees.

9. “Dean – Student Affairs” is responsible for all student related activities including student discipline, extra and co-curricular activities, attendance and meetings with class representatives, Student Council and parents.

10. “HoD” means, the Head of the Department concerned.


12. “TCH” means, Total Contact Hours – refers to the teaching–learning periods.

13. “DEC” means, Department Exam Committee

14. “BoS” means, Board of Studies

15. “BoM” means, Board of Management

16. “ACM” means, Academic Council Meeting which is the highest authoritative body for approval for all Academic Policies.

17. “Programme Coordinator” (PC) is a faculty of a department who in charge of the PG students of a specialization, who takes care of the attendance, internal marks and the general conduct of the students of that specialization.

18. “CIA” is Continuous Internal Assessment which is assessed for every student for every course during the semester.

19. “ESE” is End Semester Examination which is conducted by the Institute at the End of the Semester for all the courses of that semester.

20. “AICTE” means, All India Council for Technical Education

21. “UGC” means, University Grants Commission

22. “MHRD” means, Ministry of Human Resources Development, Govt. of India.


24. “RA” Grade means, Re appear due to lack of minimum attendance.

25. “RC” Grade means, Repeat the Course during the Summer / Winter break.

26. “DCC” means, Department Consultative Committee
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Vision, Mission and Objectives

1.0 Vision, Mission and Objectives

MOTTO
To Make Every Man a Success and No Man a Failure.”

VISION
To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

MISSION
• To create an ecosystem for learning and world class research.
• To nurture a sense of creativity and innovation.
• To instill highest ethical standards and values with a sense of professionalism.
• To take up activities for the development of Society.
• To develop national and international collaboration and strategic partnership with industry and institutes of excellence.
• To enable graduates to become future leaders and innovators.

VALUE STATEMENT
• Integrity, Innovation, Internationalization.

Further, the Institute always strives
• To train our graduates and Post graduates with the latest and the best in the rapidly changing fields of Engineering, Technology, Management studies, Science and Humanities.

• To develop graduates and Post graduates with a global outlook possessing Knowledge, Skills and Attitude capable of taking up challenging responsibilities in the respective fields.

• To mould our graduates and post graduates as citizens with moral, ethical and social values so as to fulfill their obligations to the nation and the society.

• To promote research in the field of Science, Humanities, Engineering, Technology and allied branches.

1.3 Aims and Objectives of the Institute are focused on
• Providing state of the art education in Engineering, Technology, Applied Sciences and Management studies.
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- Keeping pace with the ever changing technological scenario and help the graduates and post graduates to gain proper direction to emerge as competent professionals fully aware of their commitment to the society and the nation.

- To inculcate a flair for Research, Development and Entrepreneurship.

ACADEMIC REGULATIONS FOR M. Tech., M. Plan and M.Arch.(Executive)
(Effective from Academic year 2018 - 19)

R.1.0 Admission

R.1.1. The admission policy and procedure shall be decided from time to time by the Board of Management (BOM) of the Institute based on the guidelines issued by the UGC/AICTE/Ministry of Human Resource Development (MHRD), Government of India. The number of seats in each branch of the M. Tech / M. Plan and M. Arch (Executive) programme will be decided by the Board of Management of the Institute as per the guidelines of AICTE/UGC/MHRD/COA, Government of India, taking into account the market demands. Some Seats are also made available for Non-Resident Indians and foreign nationals, who satisfy the admission eligibility norms of the Institute.

R.1.2. Eligibility for Admission

- The selected candidates will be admitted to the M. Tech / M.Plan and M. Arch (Executive) programme after he/she fulfills all the admission requirements set by the Institute and after payment of the prescribed fees.

- Candidates for admission to the first semester of the Master’s Degree Programme shall be required to have passed an appropriate UG Degree Examination recognized by Hindustan Institute of Technology and Science.

- In all matters relating to admission to the M. Tech / M.Plan and M. Arch (Executive) Programme, the decision of the Institute and its interpretation given by the Chancellor of the Institute shall be final.

- If at any time after admission, it is found that a candidate has not fulfilled any of the requirements stipulated by the Institute, the Institute may revoke the admission of the candidate with information to the Academic Council.

- Candidates for admission to M.Plan shall be required to have passed B.Arch / B.E or B.Tech (Civil) / B.Plan / M.Sc (Geography/Economics/Sociology) Degree Examination recognized by Hindustan Institute of Technology and Science with a minimum of 50% marks in aggregate.
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- Candidates for admission to the M.Arch (Executive) shall be required to have passed B.Arch Degree Examination recognized by Hindustan Institute of Technology and Science with a minimum of 50% marks in aggregate.

R.1.3. If at any time after admission, it is found that a candidate has not fulfilled one or many of the requirements stipulated by the Institute, or submitted forged certificates, the Institute has the right to revoke the admission of the candidate and will forfeit the fee paid and legal action may be taken against the candidate as decided by the board of Management.

R.2.0 Structure of the M.Tech / M.Plan and M. Arch (Executive) Degree Programme

R.2.1 The M.Tech / M.Plan and M. Arch (Executive) programme in all streams of specialization will be structured on a credit based system following the semester pattern with continuous evaluation.

R.2.2 The Institute permits regular as well as external registration (part time) for those in employment. M. Arch (Executive) is a part time programme with a normal duration of three years (six semesters) aimed for those who are in employment.

R.2.3 The programme of instruction for each stream of specialization will consist of:
   i. Core courses (compulsory)
   ii. Soft Core Courses and/or Elective courses
   iii. Laboratory/Seminar/Mini Project/Design/Studio/Industrial Training, and
   iv. Project work and dissertation/Thesis

R.2.4 Every stream of specialization in the programme will have a curriculum and syllabi for the courses approved by the ACM Curriculum revisions, when required, will be proposed by a committee nominated by the Dean(PGS). All revisions shall be recommended by the BOS of the concerned departments/Schools and approved by the ACM.

R.2.5 The curriculum for any stream of specialization shall have a minimum total of 65 credits for successful completion of the M. Tech. programme. The curriculum shall have a minimum total of 75 credits for successful completion of the M. Plan. Programme and a minimum total of 70 credits for successful completion of the M. Arch (Executive) programme.

R.2.6 The complete programme will be of FOUR semesters’ duration for M. Tech / M. Plan Programmes. The academic programmes in each semester for any stream of specialization may consist of course (core and/or electives) work and/or
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laboratory/seminar/project/industrial training/thesis as specified in the approved curriculum (R.2.3).

R.2.7 Credits will be assigned to the courses based on the following general pattern:

i. One credit for each lecture period

ii. One credit for each laboratory / practical session / Studio of two periods

iii. Two credits for each laboratory or practical session of more than two periods

R.2.8 A student will have to register for all the core courses listed in the curriculum of his/her selected area of specialization and successfully complete all of them.

R.2.9 Elective courses will have to be taken from the courses offered in a particular semester from among the list of approved courses as per the curriculum.

R.2.10 Departments/Schools have to offer all the core courses prescribed in the curriculum for any semester. Sufficient number of elective courses shall also be offered in line with the curriculum. Number of elective courses and other courses, if any, from the curriculum, to be offered in any semester can be decided by the HoD/Dean(PGS) based on the requirement/pre-registration data.

R.2.11 Departmental Elective (DE) courses enabling the students to take up a group of courses of their interest in the area of specialization offered by the parent Department / School.

R.2.12 Open Electives (OE) are courses offered by Engineering and Non-Engineering departments (across disciplines) other than their parent Department.

R.2.13 A student who has acquired the minimum number of total credits (M. Tech:65 / M. Plan: 75 and M. Arch (Executive): 70) for the award of the degree will not be permitted to register for more courses to improve his cumulative grade point average (CGPA) after completion of the course and project requirements.

For M. Tech / M. Plan Programmes, However, during the third/fourth semester, along with the project, a student can register for a maximum of two courses in addition to the project/thesis as per curriculum. These two additional courses permitted will be inclusive of any courses in which he/she has failed in the earlier semesters or inclusive of any courses he/she is planning to audit. The total number of credits for such students who take additional courses will be as per R.5.7.

Students who take courses in the third or fourth semesters will not be normally permitted to do their project work/thesis outside as per R.10.0.

For M. Arch (Executive) Programmes, however, during the fifth/sixth semester, along with the project, a student can register for a maximum of two courses in addition to the
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Project/Thesis as per curriculum. These two additional courses permitted will be inclusive of any courses in which he/she has failed in the earlier semesters or inclusive of any courses he/she is planning to audit. The total number of credits for such students who take additional courses will be as per R. 5.7.

Students who take courses in the fifth or sixth semesters will not be normally permitted to do their project work/thesis outside as per R. 10.0.

R. 2.14 The medium of instruction, examination, seminar and project reports will be English.

R. 2.15 For students admitted on external registration, the normal duration of the programme will be 6 semesters. For slow learners, the maximum duration to complete the programme is 8 semesters for M. Tech / M. Plan and M. Arch (Executive).

R. 2.16 The Institute permits a regular student to change over to external registration during the programme, under specific circumstances like initiating a start-up venture or to take up a job as per R. 9.0.

R. 2.17 A pass is mandatory in all core courses. In case of failure in an elective course, there is the provision to choose another elective listed in the curriculum.

R. 2.18 On their request, ACM shall examine the academic records and permit candidates with B. Tech (Honours) who have earned credits for any relevant graduate level courses to transfer credits towards the M. Tech./ M. Plan programme provided the courses are core courses of the M.Tech/M.Plan.

R. 2.19 Candidates who received B. Tech (Honours) degree just prior to their M. Tech / M. Plan admission are permitted to transfer up to 9 credits. For those who received the B. Tech (Honours) degree within three years prior to their M. Tech / M. Plan admission is permitted to transfer up to 6 credits.

R. 2.20 The maximum number of lecture based courses and laboratory courses in any semester shall not exceed 6 and 2 respectively. The maximum credits in a semester shall be 23. The maximum number of lecture based courses and Studio courses in any semester shall not exceed 6 and 2 respectively for M. Plan. The maximum credits in a semester shall be 22. The maximum number of lecture based courses and Studio courses in any semester shall not exceed 4 and 1 respectively for M. Arch (Executive). The maximum credits in a semester shall be 13.

R. 2.21 Extension of Programme: The normal duration of the programme shall be four semesters for M. Tech / M. Plan. In case of prolonged illness or other personal exigencies, the institute
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may allow a student who has earned credits for at least one semester, to extend the programme up to the maximum duration of six semesters.

The normal duration of the programme shall be Six semesters for M. Arch (Executive). In case of prolonged illness or other personal exigencies, the institute may allow a student who has earned credits for at least one semester, to extend the programme up to the maximum duration of eight semesters.

R.2.22 Students who have earned credits for the courses listed in the first two semesters are permitted to transfer their registration as external candidates if they take up a job. However, they have to complete the programme within six semesters.

R.2.23 A student must earn a minimum number of credits under each category as shown in Table 1 and also a minimum total of 65 credits for the award of M. Tech. degree.

<table>
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<th>Sl. no.</th>
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<th>Credits</th>
<th>Percentage</th>
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<td></td>
<td></td>
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<td>2</td>
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<td>65</td>
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</table>

A student must earn a minimum number of credits under each category as shown in Table 1A and also a minimum total of 75 credits for the award of M. Plan. Degree.
A student must earn a minimum number of credits under each category as shown in Table 1A and also a minimum total of 70 credits for the award of M. Arch (Executive) Degree.
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### Table: 1B Credits under Each Category

<table>
<thead>
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<th>Sl. No</th>
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<th>No. of Courses</th>
<th>Credits</th>
<th>Percentage</th>
<th>Total</th>
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<td>Mandatory Learning Courses (MLC)</td>
<td>Research methodology &amp; IPR</td>
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<td>17</td>
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</table>

### R.3.0 Programme Coordinator (PC)

R.3.1 To help the students in planning their courses of study and for getting general advice on the academic programme, the concerned department/School will assign a ‘Programme Coordinator’ for each M. Tech./ M. Plan and M. Arch (Executive) programme.

(i) In Departments/schools offering more than one M.Tech. / M.Plan and M. Arch (Executive) programmes, one of the Programme Coordinators nominated by HoD will act as the Coordinating Programme Coordinator who will coordinate general matters of all M.Tech. / M.Plan and M. Arch (Executive) programmes in the Department/schools.

(ii) Students shall first approach their PC for all kinds of academic advices, course registrations, leave and all academic related matters in the Institute. Whenever required, he/she shall provide necessary advice to the students. PC shall make appropriate recommendations or remarks on the applications submitted by the students before forwarding to HoD/other concerned officials. PC will keep the complete record of academics, attendance/leave, disciplinary actions if any, and any other relevant data of the students assigned to him/her.

### R.4.0 Class Committee.

R.4.1 For each Semester of M. Tech., / M. Plan and M. Arch (Executive) programmes, a Class Committee will be constituted by the Head of the Department as follows:

(i) Chairperson: Professor or a Senior Faculty member/Programme Coordinator of the
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concerned M. Tech. / M. Plan and M. Arch (Executive) programme nominated by the HoD.

(ii) Members: 1) All faculty members/Course Coordinator (if the same course is handled by different faculty) handling courses for the M. Tech. / M. Plan and M. Arch (Executive) programme.

2) Programme Coordinator of the concerned M. Tech. / M. Plan and M. Arch (Executive) programme, if he/she is not the Chairperson.

3) One or two student members as representatives from the M. Tech. / M. Plan and M. Arch (Executive) programme, nominated by the PC/HoD.

R.4.2 The term of the Class Committee shall be one semester. The VC and Dean (PGS) or his/her nominee or HoD shall have the right to be present in any class committee meetings. The Chairperson of the committee shall record the proceedings of each meeting and communicate a copy of each meeting to the concerned HoD for any further actions.

R.4.3 The responsibilities of the Class Committees include the following:

i) Finalise the course plan/evaluation/assessment submitted by the course faculty/DEC.

ii) Review periodically the progress of the classes and the attendance of the students,

iii) Identify students with poor performance in the tests and low attendance. The list of such students shall be reported to the PC. These students shall be motivated or given necessary advice/warning through PC/HoD.

iv) Discuss the problems concerning the conduct of the classes with reference to the curriculum and syllabi and make suitable suggestions and recommendations. These points shall be communicated to HoD by the Chairperson.

v) Any other academic matters related to the concerned class.

vi) Arrange/coordinate make-up/supplementary examinations, if any, by the Chairperson of the class committee for students in coordination with the DEC/CoE.

R.4.4 The course plan and the method of evaluation/assessment will be prepared by the concerned Course faculty/Course Coordinator and will be announced in the class in the beginning of the semester. These details will be presented/discussed in the first class committee (to be conducted within two weeks from the beginning of the semester) by the course faculty and modifications if any, based on the discussions shall be made. All such
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records shall be filed and kept by the Chairperson of the class committee.

R.4.5 The Class Committee and Course Committees shall meet at least thrice in a semester as per the Academic Plan issued by the Dean(PGS)/Dean(Academics). It is desirable that the Class Committee may meet in the beginning of the semester, after the mandatory test series for analyzing the performance of the students and to initiate steps to motivate academically weak students.

R.5.0 Registration and Enrolment

R.5.1 The process of signing up for courses is called registering. Students are enrolled after they pay the prescribed fees. For a student to attend classes he has to complete both registration and enrolment. All students shall formally register for the courses every semester to undergo course work. The concerned Programme Coordinator will guide the students in the registration process.

R.5.2 Registration of any course will be controlled by the concerned Head of the department. Except for the first semester, the registration for a semester will be done during a specified week before the end-semester examination of the previous semester.

R.5.3 A student shall be eligible for enrolment only if he/she completely satisfies the minimum requirement to continue the programme as per rule R.6.0 and shall be permitted to enroll only if (i) he/she has cleared all the dues in the Institute, hostel & library up to the end of the previous semester and (ii) he/she is not debarred from enrolment by a disciplinary action of the Institute (iii) he/she has paid all the tuition fees and all other relevant fees, if any, prescribed by the Institute.

R.5.4 Students shall complete formalities like teacher evaluation of the courses registered in the previous semester, pre-registration etc., if any, as notified by the Dean(PGS) before the registration to the next semester.

R.5.5 Students shall submit the course registration form duly filled in to enter in ERP, in consultation with his/her PC, fee receipt and registration chit or any other forms in the prescribed format with all necessary enclosures, as required and notified by Dean(PGS)

R.5.6 If for any compelling reasons a student is unable to register on the day of registration, he/she can register on or before the late registration day specified in the academic calendar on payment of late registration fee together with the usual fees.
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R.5.7 For M. Tech / M. Plan Maximum number of courses/credits that can be registered by a student in any semester corresponds to the total courses prescribed for the semester as per curriculum. However, students are permitted to audit course/s in Third and Fourth Semesters of the programme. Only a maximum of two audited courses for which a minimum pass secured shall be recorded in the grade card.

For M. Arch (Executive) Maximum number of courses/credits that can be registered by a student in any semester corresponds to the total courses prescribed for the semester as per curriculum. However, students are permitted to audit course/s in fourth and fifth Semesters of the programme. Only a maximum of two audited courses for which a minimum pass secured shall be recorded in the grade card.

R.5.8 Student has to ensure that his/her name is included in the list of registered students with each course faculty at the beginning of the semester on the first instructional day itself. If not, he/she has to contact PC.

R.5.9 Course adjustment by adding/dropping course(s) to/from the initial registration is permitted on valid reasons, within two weeks of the commencement of the semester or as mentioned in the academic calendar, whichever is earlier, with the written approval of his/her PC and HoD.

However, the student should ensure that the total number of credits registered for in any semester should satisfy the maximum and minimum credit limits as per rule 5.7 and also should enable him/her to earn the minimum number of credits per semester as per R.6.0.

Courses dropped will have to be taken when they are offered in the following semesters, if they belong to the list of core courses, which are compulsory.

R.6.0 Minimum Requirement to Continue the Programme

R.6.1 Students of M. Tech./ M. Plan should have earned 50% of the credits registered in first semester, and 60% of the credits prescribed in first and second semester together for continuing the programme in second and third semester respectively.

R.6.2 The above stipulation can be relaxed, if the student is permitted by the Dean(PGS) to discontinue temporarily any semester on medical reasons, based on his/her request with the recommendation of PC, HoD/DCC.

R.6.3 If a student earns RA grade (due to lack of minimum attendance) in all theory courses
prescribed in a semester, he/she will be detained and will not be allowed to proceed to the next semester. He/she has to re-register for the courses in the following academic year only.

**R.7.0 Maximum Duration of the Programme**

R.7.1 A student is, normally, expected to complete the M.Tech. / M. Plan programme in four semesters. The Maximum duration to complete the M.Tech. / M. Plan programme is *four years* from the date of admission. This is inclusive of all the periods including the period of temporary discontinuation or any other period of absence permitted.

A student is, normally, expected to complete the M. Arch (Executive) programme in six semesters. The Maximum duration to complete the M. Arch (Executive) programme is *five years* from the date of admission. This is inclusive of all the periods including the period of temporary discontinuation or any other period of absence permitted.

**R.8.0 Temporary Discontinuation**

R.8.1 A student may be permitted by the Dean (PGS) to discontinue temporarily from the programme for a semester or a longer period for reasons of ill health or other medical reasons, based on the recommendation from PC and HoD.

R.8.2 In case of ill health or other genuine medical reasons, students must produce a medical certificate from a Registered Medical Practitioner stating that he/she is not in a position to continue with the studies temporarily specifying the period, and the same should be duly endorsed by the Institute Medical Officer. Normally, a student shall be permitted to discontinue from the programme only for a maximum duration of two semesters.

R.8.3 Before joining back to the programme, the student should submit the fitness certificate from the medical practitioner who treated him/her, with endorsement from the Institute Medical Officer.

R.8.4 In case of change in the curriculum/syllabus, a student has to register for the approved equivalent courses (meeting the same credits) as per the revised curriculum/syllabus in line with the advice of PC, whenever he/she is allowed to continue the programme after the period of discontinuation.

**R.9.0 Discontinuation from the Programme to Take up a Job**

R.9.1 Students may be permitted to discontinue the programme and take up a job provided they have completed all the course work (except major project) prescribed in the approved
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curriculum, subject to the rules and regulations for the award of the financial support in force in the Institute.

The project work/thesis can be done during a later period either in the organization where they work if it has R & D facility, or in the Institute. Students desirous of discontinuing their programme at any stage after the successful completion of course work (except major project) with the intention of completing the major project work/thesis at a later date should submit application with details (copy of employment offer, plan of completion of their project etc.) to the Dean (PGS) through PC and HoD.

R.9.2 When the students are planning to do the project/thesis in the organization with R & D facility where they are employed, they shall submit a separate application as per rule R.10.4. When students are doing project/thesis along with the job in the organization (with R & D facility) where they are employed, the project work shall be completed in four semesters normally (two semesters of project work/thesis along with the job may be considered as equivalent to one semester of project work at the Institute). Extensions may be granted based on requests from the student and recommendation of guide/PC such that he/she will complete the M. Tech. / M. Plan programme within four years from the date of admission as per R.7.0. Method of evaluation and grading of the project/thesis will be the same as per R.16.0 and R.20.0, respectively.

R.9.3 When the students (who have been permitted to discontinue the programme to take up a job) are planning to do the project/thesis in the Institute, they shall submit an application (along with the permission to carry out the project work at the Institute from the employer) to the Dean (PGS) with recommendation of PC and HoD for permission to do the project/thesis. The project work/thesis shall be done as full time students in the Institute and can be completed in two semesters.

R.9.4 For those students who discontinue the programme as per R.9.0, financial support from the Institute (if any) will not be available from the date of discontinuation. Fees to be paid will be decided, as per the Institute rules, by the Dean (PGS).

R.10.0 Project Work/thesis in Industry or other Organisations

R.10.1 Sponsored candidates from Research and Development Organizations/Industries which have facilities for research work in the area proposed, may be permitted to carry out their project work/thesis in the parent or similar Organizations/Industries, only if they have successfully completed the course work prescribed in the approved curriculum and received permission from the parent Organizations/Industries for the same.
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R.10.2 Students who receive fellowship in a research project in an organization or internship in an industry can pursue their main project work/thesis at the organization/industry only if they have successfully completed the course work prescribed in the approved curriculum.

R.10.3 All other categories of students are permitted to do the project work/thesis in R&D Organizations/Industries which have facilities for research work in the area proposed, only under the following conditions:

(i) They have completed successfully the course work prescribed in the approved Curriculum, and

(ii) Facilities required for the Project work/Thesis are available continuously in the Organization/Industry (A certificate stating the facilities available in the proposed organization and the time period for which the facilities shall be made available to the student, issued by a competent authority from the Organization/Industry shall be submitted by the student along with the application).

R.10.4 DCC/HoD shall examine the requests submitted from all such students with the recommendation from PC along with following documents:

(i) Details of the proposed work

(ii) Work plan of completion of project

(iii) Name of R&D Organization/Industry in which the project/thesis is to be carried out

(iv) Letter from the competent authority from the Organization/Industry granting permission to do the project/thesis with or without fellowship/internship.

(v) Name and designation of an external guide from the proposed Organization/Industry (Scientists or Engineers with a minimum post graduate degree in the related area) and his/her profile with consent.

(vi) Name of a faculty member of the Institute as internal guide with his/her consent.

(vii) Certificate issued by the competent authority from the Organization/Industry clearly stating the facilities available in the proposed organization and the time period for which the facilities shall be made available to the student. (Only for students as per R.10.3). Dean(PGS) will grant the approval based on the recommendations from DCC/HoD.

R.10.5 The students who are permitted to do the project work/thesis in an industry as per R.10.1 – R.10.3 will have to pay the tuition and other relevant fees to the Institute as per rules. They will not be eligible to receive any financial support from the Institute during this period, if they are receiving any financial support from the organization/ industry in which they are doing the project work.
R.11.0 Student Discipline

R.11.1 Every student is required to observe utmost discipline and decorum both inside and outside the campus and not to indulge in any activity which may affect adversely the prestige/reputation of the Institute.

R.11.2 Any act of indiscipline of a student shall be reported to the Dean (PGS). The Committee constituted by Dean (PGS) will enquire into the charges and decide on a suitable punishment if the charges are substantiated. The committee will report to Dean (PGS) and authorize the Dean(PGS) to implement the decision.

R.11.3 The punished students, if any, may appeal to the Vice Chancellor whose decision will be final and binding in all respect.

R.11.4 Ragging in any form is a criminal and non-bailable offence in our country. The current State and Central legislations provide for stringent punishments including imprisonment. Once the involvement of a student(s) is established in ragging, offending fellow students/staff, harassment of any nature to the fellow students/staff etc. the student(s) will be liable to be dismissed from the Institute, as per the laid down procedures of the UGC / Govt. /Institute. Every senior student of the Institute, along with their parent, shall give an undertaking every year in this regard and the same should be submitted at the time of Registration.

R.12.0 Attendance

R.12.1 The faculty handling a course must finalise the attendance 3 calendar days before the last instructional day of the course and submit to the HOD through PC.

R.12.2 A student whose attendance is less than 75% (Total Contact periods - “TCH”) in any course, whatever may be the reason for the shortfall of the attendance, will not be permitted to appear for the end-semester examination in that particular course in which attendance shortfall exists. The student is however permitted to avail Academic Leave up to 10% for attending academic related activities like, Industrial Visits, Seminars, Conferences, Competitions etc., with the prior approval of the HoD through PC. The student shall submit the proof of documents after the event to the HoD for approval of the Academic Leave.

R.12.3 The remaining 25% allowance in attendance is given to account for activities under NCC / NSS / Cultural / Sports/ Minor Medical conditions etc.

R.12.4 A student who earns an attendance (“TCH” – Total Contact Periods) between 40% and 75% in any course will be awarded a grade of “RC” which means Repeat the Course during the
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Summer / Winter break. Students with “RC” grades will not be permitted to attend the Regular End Semester Examinations for that course. During the Summer / Winter break the regular courses of the respective semester will be offered as Summer/Winter Courses to enable the students to get required attendance and internal assessment marks to appear in the repeat exam.

R.12.5 Students with “RC” grade in any course shall attend the immediately following Summer / Winter course. The detailed schedule of the Summer / Winter courses offered in every semester will be announced during the end of that semester. The student who have obtained “RC” has to select their appropriate slots and courses, optimally to attend the courses

R.12.6 The student, whose attendance falls below 40% for a course in any semester, will be categorized as “RA”, meaning detained in the particular course for want of attendance and they will not be permitted to write the End semester exam for that course. The procedure for repeating the course categorized as “RA” is mentioned in R.19.

R.12.7 Additional condonation may be considered in rare and genuine cases which includes, approved leave for attending select NCC / Sports Camps, cases requiring prolonged medical treatment and critical illness involving hospitalization.

For such select NCC / Sports Camps prior permission for leave shall be obtained by the respective faculty coordinator / Director of sports from the designated authority, before deputing the students

R.12.8 For medical cases submission of complete medical history and records with prior information from the parent / guardian to Dean (PGS) is mandatory.

R.12.9 The assessment of such cases will be done by the attendance sub – committee (constituted by HoD) on the merit of the case and put up recommendations to the Vice Chancellor. Such condonation is permitted only once for a student in the entire duration of the programme. The Vice Chancellor, based on the recommendation of the attendance sub - committee may then give condonation of attendance, only if the Vice Chancellor deems it fit and deserving, but in any case the condonation cannot exceed 10%.

R.13.0 Leave

R.13.1 Students are eligible for: (i) leave on medical grounds duly supported by medical certificate from a registered medical officer with endorsement from Institute medical officer up to 7 days per semester (iii) duty leave up to 20 days per year for data
collection/testing/measurements/attending workshops/conferences/presenting their papers etc. in connection with their project / Thesis. Additional period of duty leave, if required, may be sanctioned by Dean (PGS) based on the recommendation of guide/HoD. All leave applications shall be submitted with supporting documents to the HoD with the recommendations of PC/guide.

R.13.2 Students must attend all the classes for the courses which are registered by him/her without fail. If a student cannot attend any of the classes due to sickness or any compelling reasons judged to be valid by the PC/HoD, same shall be informed to the course faculty and PC in advance, if possible or at the earliest. Student shall submit leave application with recommendations of PC to the HoD in advance, if possible or at the earliest.

If the number of days of absence due to medical reasons, as stated above, does not exceed 7 consecutive days, application for medical leave, supported by medical certificate from a registered medical officer with the endorsement by the Institute Medical Officer, shall reach the HoD with recommendations from PC, within five instructional days after returning from leave or, on or before the last instructional day of the semester, whichever is earlier. Application for Medical Leave will be considered only in cases where the student is not in a position to attend any of the classes during the period mentioned in the Medical Certificate. Medical Leave for a period of more than 7 consecutive days shall be admissible only in the case of ill-health requiring hospitalisation/physical indisposition with inability to move, such that the student is not in a position to attend any of the classes during the period of Medical Leave applied for. In such cases, the application for Medical Leave should be accompanied by appropriate supporting documents (such as Discharge Summary/treatment records) in addition to the medical certificate obtained from a registered medical practitioner. All the supporting documents and medical certificate are to be endorsed by the Institute Medical Officer. The application for Medical Leave, along with the above documents, should be submitted to the Dean (PGS) with recommendation from the PC and HoD. In all such cases the decision on granting the Medical Leave will be taken by a sub-committee constituted by the Dean (PGS).

The students who are granted Medical Leave for more than 7 days consecutively shall produce Medical Fitness Certificate after returning from leave, for continuing the programme.

(ii) Medical Leave should have been granted by the competent authority, in response to the application for Medical Leave submitted within the stipulated time (within five instructional
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days after returning from leave or, on or before the last instructional day of the semester, whichever is earlier), as stated in R.13.2.

R.14.0 Assessment Procedure

R.14.1 Every course shall have two components of assessment namely,

a. Continuous Internal Assessment “CIA”. This assessment will be carried out throughout the semester as per the Academic Schedule

b. End Semester Examination “ESE”. This assessment will be carried out at the end of the Semester as per the Academic Schedule

The weightages for the various categories of the courses for CIA and ESE is given in Table 2.

Table 2 Weightage of the CIA and ESE for various categories of the courses

<table>
<thead>
<tr>
<th>No.</th>
<th>Category of Courses</th>
<th>CIA Weightage</th>
<th>ESE Weightage</th>
<th>Pass minimum (CIA +ESE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Theory Course</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>2.</td>
<td>Practical Course</td>
<td>80%</td>
<td>20%</td>
<td>50%</td>
</tr>
<tr>
<td>3.</td>
<td>Theory Course with Practical Components</td>
<td>60%</td>
<td>40%</td>
<td>50%</td>
</tr>
<tr>
<td>4.</td>
<td>Department (DE)/ Non – Department Elective (OE)</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>5.</td>
<td>Design Project</td>
<td>100%</td>
<td>---</td>
<td>50%</td>
</tr>
<tr>
<td>6.</td>
<td>Studio Project</td>
<td>60 %</td>
<td>40 %</td>
<td>50 %</td>
</tr>
<tr>
<td>7.</td>
<td>Internship</td>
<td>100%</td>
<td>---</td>
<td>50%</td>
</tr>
<tr>
<td>8.</td>
<td>Thesis / Project and Viva Voce</td>
<td>70%</td>
<td>30%</td>
<td>50%</td>
</tr>
</tbody>
</table>

To earn credits in a course, a minimum of 40% marks in End Semester Examination alone is a must.
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R.14.2 Theory Course / DE / OE Assessment weightages:

The general guidelines for the assessment of Theory Courses, Department Electives “DE” and Non – Department Electives “OE” shall be done on a continuous basis is given in Table 3.

Table 3: Weightage for Assessment

<table>
<thead>
<tr>
<th>No.</th>
<th>Assessment</th>
<th>Weightage</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First Periodical Assessment</td>
<td>15%</td>
<td>1 period</td>
</tr>
<tr>
<td>2</td>
<td>Second Periodical Assessment</td>
<td>20%</td>
<td>1.5 periods</td>
</tr>
<tr>
<td>3</td>
<td>CIA Seminar/Assignments/term Project/Surprise Test / Quiz etc.,</td>
<td>15%</td>
<td>----</td>
</tr>
<tr>
<td>4</td>
<td>ESE End Semester Exam</td>
<td>50%</td>
<td>3 hours</td>
</tr>
</tbody>
</table>

R.14.3 Practical Course: For practical courses, the assessment will be done by the course teachers as below:

Weekly assignment/Observation / lab records and viva as approved by the Department Exam Committee “DEC”

a. Continuous Internal Assessment -- 80%;  b. End Semester Examination -- 20%

R.14.4 Theory courses with practical Component: For theory courses with practical component the assessment will be calculated as follows as approved by the “DEC”.

a. Continuous Internal Assessment -- 60%;  b. End Semester Exam -- 40%

R.15.0 Internship:

R.15.1 A student has to compulsorily attend Summer internship between second and third semester for a minimum period of two months preferably in an industry. In lieu of Summer internship, the student is permitted to register for project work under a faculty of the Institute and carry out the project for minimum period of two months. This can be a part of the major project. In both the cases, the internship report in the prescribed format duly
certified by the faculty in-charge shall be submitted to the HOD. The evaluation will be done through presentation and viva. The course will have a weightage of two credits as defined in the respective curriculum.

R.16.0 Project work/Thesis Evaluation

R.16.1 Project / Thesis work is spread over the third and fourth semesters. Project / Thesis work is to be evaluated both in the third and the fourth semesters. Based on these evaluations the grade is finalised only in the fourth semester.

Project evaluation weights shall be as follows:

For convenience the marks are allotted as follows.

Total marks for the Project: 150
In the 3rd Semester: - Marks: 50

Project/ Thesis Progress evaluation details:

Progress evaluation by the Project Supervisor: 20 Marks
Presentation and evaluation by the committee: 30 Marks
In the 4th Semester: - Marks: 100
Project/ Thesis evaluation by the supervisor/s: 30 Marks
Presentation & evaluation by the Committee: 40 Marks
Evaluation by the External expert: 30 Marks

For M. Arch (Executive) Thesis work is spread over the fifth and sixth semesters. Thesis work is to be evaluated both in the fifth and the sixth semesters. Based on these evaluations the grade is finalised only in the sixth semester.

Thesis evaluation weights shall be as follows:

For convenience the marks are allotted as follows.

Total marks for the Project: 150
In the 5th Semester: - Marks: 50

Project Progress evaluation details:

Progress evaluation by the Project Supervisor: 20 Marks
Presentation and evaluation by the committee: 30 Marks
In the 6th Semester: - Marks: 100
Project evaluation by the supervisor/s: 30 Marks
Presentation & evaluation by the Committee: 40 Marks
Evaluation by the External expert: 30 Marks
R.16.2. Publications

Every M.Tech. student shall publish minimum a journal or Conference paper from the project work done during the programme. Out of the 20 credits for the Project work/Thesis, 5.0 (five) credits will be for publication. A student with a publication in an indexed journal will get 5.0 (five) credits and publication in a reputed conference will get 2.0 (two) credits respectively towards publication.

R.17.0 Flexibility in Assessment:

The respective Departments under the approval of the Department Exam Committee (DEC) may decide the mode of assessment, based on the course requirements.

R.18.0 Procedures for Course Repetition

R.18.1 Summer / Winter Course: - for “RC” Category

a. The students who secures “RC” grade (Attendance between 40% and 74% for course(s) are eligible for registering for the Summer / Winter Course which will be conducted during the Summer / Winter break, to improve their Attendance by paying the requisite fee.

b. The Odd semester regular courses will only be offered during the Winter break and the Even semester regular courses will only be offered during the Summer break.

c. Students having “RC” category any course(s), shall register and attend the classes during the summer / winter break, gain the requisite attendance and take assessments to become eligible for reappearing for the respective course(s) during the immediately following Repeat Examination.

d. The students under “RC” who fail to improve their attendance through summer/winter will be categorized under “RA” for that course.

R.19.0 Course – Repetition - “RA” Category

R.19.1 If a student is detained in any course(s) in any semester for shortage of attendance under “RA”, he/she shall re-register for the same course once again whenever it is offered next and secure required attendance to become eligible to appear for the end semester examination for that course, by paying the requisite fee.
R.19.2 A student will be permitted to register for not more than 2 “RA” courses in a semester. It is the responsibility of the student to schedule their timetable to include the “RA” courses without affecting the attendance of the other regular courses of the current semester. Students may have to drop courses in their regular semester.

R.20.0 Repeat Examinations

R.20.1 Normally, the results of the End Semester Examinations for Regular Theory courses are announced within a period of 10 days after the last regular examination. The students who wish to apply for revaluation of regular courses can do so immediately after the announcement of results.

R.20.2 The students with “RC” grades, who have secured the requisite attendance by successfully completing the Summer / Winter course, are eligible to register for the Repeat Examinations.

R.20.3 The students who fail to secure a pass “U” Grade or being absent for genuine reasons in their End Semester Examination for the regular courses are also permitted to appear for the Repeat Exams by paying the prescribed fee. They need not attend the Summer / Winter Courses.

R.20.4 The schedule for the Repeat Examinations will be as per the Academic Calendar which will be published at the beginning of every academic year. Normally, the Repeat Examinations will be conducted at the end of the Summer / Winter Courses for regular theory courses of that semester. The assessment of such cases will be done by the attendance sub-committee on the merit of the case and put up recommendations to the Vice-Chancellor. **Such condonation is permitted only once for a student in the entire duration of the programme.**

The Vice Chancellor, based on the recommendation of the attendance sub-committee may then give condonation of attendance, only if the Vice Chancellor deems it fit and deserving, but in any case the condonation cannot exceed 10%.

R.21.0 Grading

R.21.1 **Letter grade**

Based on the performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and corresponding grade points are given in Table 4.
**Table 4: Grading system**

<table>
<thead>
<tr>
<th>Range of Marks</th>
<th>Letter Grade</th>
<th>Grade Points</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 – 100</td>
<td>S</td>
<td>10</td>
<td>Outstanding</td>
</tr>
<tr>
<td>80 - 89</td>
<td>A</td>
<td>09</td>
<td>Excellent</td>
</tr>
<tr>
<td>70 - 79</td>
<td>B</td>
<td>08</td>
<td>Very Good</td>
</tr>
<tr>
<td>60 - 69</td>
<td>C</td>
<td>07</td>
<td>Good</td>
</tr>
<tr>
<td>50 - 59</td>
<td>D</td>
<td>06</td>
<td>Pass</td>
</tr>
<tr>
<td>&lt;50</td>
<td>U</td>
<td>00</td>
<td>To Reappear for end-semester examination</td>
</tr>
<tr>
<td>--</td>
<td>RC</td>
<td>00</td>
<td>Repeat Course (Summer / Winter) due to</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Attendance deficiency (40% to 74%).</td>
</tr>
<tr>
<td>--</td>
<td>RA</td>
<td>00</td>
<td>Repeat the course for want of minimum</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>attendance (below 40%).</td>
</tr>
</tbody>
</table>

**R.22.0 Declaration of results**

R.22.1 Theory Courses / Department Elective (DE) / Non – Department Elective (OE)

A student shall secure the following minimum marks in each theory course in a semester to secure a pass in that course.

a. Pass minimum – 50% (50/100marks) (End Semester Examination marks and Continuous Internal Assessment marks taken together, with a minimum of 40% marks in End Semester Examination alone) is a must for pass minimum.

R.23.0 Supplementary Examinations:

R.23.1 If a candidate fails to secure a pass in a Theory / DE / OE courses and gets a “U” grade as per R.22.1 he/she shall register and pay the requisite fee for re-appearing in the End Semester Examination during the following semester(s). Such examinations are called Supplementary Examinations and will be conducted along with the Regular / Repeat Examinations. The Supplementary Exams for the odd semester courses will be conducted during the odd semester and supplementary exams for the even semester courses will be conducted during the even semester only. The student need not attend any contact course. The Internal Assessment marks secured by the candidate will be retained for all such attempts.
R.24.0 Re-valuation

R.24.1 A candidate can apply for the revaluation of his/her end semester examination answer paper in a theory course after the declaration of the results, on payment of a prescribed fee.

R.24.2 After 3 years, i.e., completion of one year (2 semesters) from the normal duration of the programme, the internal assessment marks obtained by the candidate will not be considered in calculating the passing requirement. A candidate who secures 50% in the semester examination (with a minimum of 40% in end semester examination) will be declared to have passed the course and earned the specified credits for the course irrespective of the score in internal assessment marks for the course.

R.24.3 If a candidate fails to secure a pass in Practical/Theory with Practical component / Design Project / Internship due to, not satisfying the minimum pass requirement “U” grade – as per R.22.1 he/she shall register and re – do the courses in the subsequent semester when offered by the departments by paying the prescribed fee.

R.24.4 Revaluation is not permitted for Practical/Theory with Practical component/Design Project / Internship. However, only for genuine grievances as decided by the Exam Grievance Committee a student may be permitted to apply for revaluation.

R.24.5 Candidate who earns required credits for award of degree after 3 years for M.Tech. / M. Plan for (on expiry of extended period of 2 semesters over and above normal duration of course) he/she will be awarded only second class irrespective of his/her CGPA. However, the period approved under temporary withdrawal, if any, from the programme (R.8.0) will be excluded from the maximum duration as mentioned above.

Candidate who earns required credits for award of degree after 4 years for M. Arch (Executive) for (on expiry of extended period of 2 semesters over and above normal duration of course) he/she will be awarded only second class irrespective of his/her CGPA. However, the period approved under temporary withdrawal, if any, from the programme (R.8.0) will be excluded from the maximum duration as mentioned above.

R.25.0 Semester Abroad Programme:

R.25.1 Students who are allowed to undergo internship or Training in Industries in India or abroad during their course work or attend any National / International Institute under semester abroad programme (SAP) up to a maximum of 1 semesters will be granted credit transfer for the Course Work/project work done by them in the Industry /Foreign Institute as per the recommendations of the credit transfer committee. The leave period of the students for
International internships / Semester Abroad programme etc., will be accounted for attendance.

**R.26.0 SGPA and CGPA**

The academic performance of a student in a semester is indicated by the Semester Grade Point Average (SGPA).

\[
\text{SGPA} = \frac{\sum (C \times GP)}{\sum C}
\]

where the summation is taken over all the courses registered by the student in the semester, except Pass/Fail courses, C indicates the number of credits for the course and GP the grade point scored by the student for the course.

The performance of a student up to and including a particular semester is indicated by the earned credits and the Cumulative Grade Point Average (CGPA). For calculating CGPA a similar formula is used where the summation is taken for all the courses credited for by the student except Pass/Fail courses if any, up to and including the recently completed semester.

R.26.3 The Grade card will not include the computation of SGPA and CGPA for courses with letter grade RA, RC and U until those grades are converted to the regular grades.

R.26.4 A course successfully completed cannot be repeated.

**R.27.0 Conversion of CGPA to Percentage Marks**

R.27.1 The CGPA can be converted to percentage of marks as follows:

\[
(\text{CGPA} - 0.5) \times 10 = \text{Percentage of marks}
\]

**R.28.0 Grade Sheet**

R.28.2 A student is considered to have completed a course successfully and earned credits if he/she secures a letter grade other than U, RC, RA in that course.

R.28.3 After results are declared; grade sheet will be issued to each student which will contain the following details:

a. Program and discipline for which the student has enrolled.

b. Semester of registration.

c. The course code, name of the course, category of course and the credits for each course registered in that semester

d. The letter grade obtained in each course
e. Semester Grade Point Average (SGPA)

f. The total number of credits earned by the student up to the end of that semester in each of the course categories.

g. The Cumulative Grade Point Average (CGPA) of all the courses taken from the first semester.

h. Credits earned under Non CGPA courses.

R.29.0 Class/Division

R.29.1 Classification is based on CGPA and is as follows:

- CGPA ≥ 8.0: First Class with distinction
- 6.5 ≤ CGPA < 8.0: First Class
- 5.5 ≤ CGPA < 6.5: Second Class.

R.29.2 Further, the award of ‘First class with distinction’ is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance with effect from I semester, within the minimum duration of the programme.

R.29.3 The award of ‘First Class’ is further subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses within 3 years for M. Tech / M. Plan programmes.

The award of ‘First Class’ is further subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses within 4 years for M. Arch (Executive) programmes.

R.29.4 The period of authorized discontinuation of the programme as per R.8.0 will not be counted for the purpose of the above classification.

R.30.0 Transfer of credits

R.30.1. Within the broad framework of these regulations, the Academic Council, based on the recommendation of the Credit Transfer Committee so constituted may permit students to transfer part of the credit earned in other approved Universities of repute & status in the India or abroad.

R.30.2 The Academic Council may also approve admission of students who have completed a portion of course work in another approved Institute of repute under lateral entry based on the recommendation of the credit transfer committee on a case to case basis.

R.31.0 Admission norms for working Professional:
CURRICULUM AND SYLLABUS

Separate admission guidelines are available for working / experienced professionals for candidates with the industrial / research experience who desire to upgrade their qualification as per recommendation of Credit Transfer Committee.

R.32.0 Eligibility for Award of the M.Tech. / M. Plan and M. Arch (Executive) Degree

R.32.1 A student shall be declared to be eligible for the award of the M.Tech. / M. Plan and M. Arch (Executive) Degree if he/she has:

(i) registered and successfully credited all the core courses of M. Tech./ M. Plan and M. Arch (Executive)

(ii) successfully acquired the credits in the different categories as specified in the approved curriculum of M. Tech. / M. Plan and M. Arch (Executive) (corresponding to the discipline of his/her study) within the stipulated time.

(iii) completed the normal duration of the programme for M. Tech. / M. Plan and M. Arch (Executive)

(iv) no dues to any departments/sections of the Institute including hostels, and

(v) no disciplinary action pending against him/her.

The award of the degree shall be recommended by ACM and approved by the Board of Management of the Institute.

Students who completed the M. Tech./ M. Plan and M. Arch (Executive) programme and are eligible for the award of the Degree can get the following documents from Registrar based on individual application, after the declaration of results: consolidated Grade Card, Provisional Degree, Course Completion, Transfer and Migration Certificates. Degree certificate will be issued during convocation as per the notifications issued by the Institute.

R.33.0 Power to modify

Notwithstanding all that has been stated above, the Academic Council is vested with powers to modify any or all of the above regulations from time to time, if required, subject to the approval by the Board of Management.
# CURRICULUM AND SYLLABUS

## M.TECH HIGHWAY ENGINEERING 2019-2020

### SEMESTER WISE COURSE DISTRIBUTION WITH CREDITS

### M.TECH – HIGHWAY ENGINEERING

**(65 CREDIT STRUCTURE)**

#### SEMESTER - I

<table>
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<tr>
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<th>C</th>
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**TOTAL** | **21** | **25**

- Research Methodology & IPR is a compulsory Course.

#### SEMESTER - II

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**TOTAL** | **19** | **22**

- One of the courses shall be a MOOC. (same course to all students)
### CURRICULUM AND SYLLABUS

#### (65 CREDIT STRUCTURE)

**SEMESTER - III**

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*Internship to be undergone during vacation between 2nd and 3rd semester

#### M.TECH – HIGHWAY ENGINEERING

##### (65 CREDIT STRUCTURE)

**SEMESTER - IV**

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TOTAL CREDITS: (21+19+13+12) = 65

#### ELECTIVES

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## CURRICULUM AND SYLLABUS

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### Course Outcomes

The Students will be able to:

1. Apply sampling principles in the field of Traffic and Highway Engineering.  
2. Describe the significance of samples using hypothesis testing.  
3. Analyze sample variance in randomized design.  
4. Interpolate data using probability theories.  
5. Apply linear programming in the field of Traffic and Highway Engineering.

### Prerequisites

Nil

### Modules

#### Module 1: Sampling Distributions and Estimation

- Sampling distributions - Point and interval estimates for population proportions, mean and variance - Maximum likelihood estimate method - Method of moments.

#### Module 2: Testing of Hypothesis

- Basic definitions of statistical hypothesis - Tests of significance for large samples - single proportion, Difference of proportion, single mean and difference of mean - Small samples – t, Chi-square and F Distributions.

#### Module 3: Design of Experiments

- Analysis of variance - One way and Two way Classifications. Completely randomized design - Randomized block design - Latin square design.

#### Module 4: Probability and Random Variables

- Discrete and Continuous random variables - Moments - Moment generating functions - Standard distributions - Binomial, Poisson, Geometric, Negative Binomial, Uniform, Normal, Exponential, Gamma and Weibull distributions - Two dimensional random variables - Joint, Marginal and Conditional distributions. Multiple and partial correlation and Regression.

#### Module 5: Linear Programming

- Basic concepts - Graphical and Simplex method - Applications

### Text Books

2. Dr. A.Singaravelu, Dr. S.Siva Subramanian and Dr. C.Ramachandran, "Probability and Queuing Theory", Meenakshi agency, 20th edition, January 2013.

### Reference Books

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<tr>
<td>2</td>
<td>Identify characteristics and uses of bitumen mixes</td>
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<td>3</td>
<td>Describe the mechanical properties of bituminous mix</td>
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<td>Design bituminous mixes based on super pave design mixes.</td>
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<tr>
<td>5</td>
<td>Design cement concrete mixes</td>
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Prerequisites: Nil

**MODULE 1: PROPERTIES OF SUBGRADE SOIL AND AGGREGATES**

Subgrade soil – Soil composition and structure – Soil classification for engineering purposes - Origin, Classification, requirements, properties and tests on road aggregates.

**MODULE 2: PROPERTIES OF BITUMEN**

Origin, preparation, properties and tests, constitution of bituminous road binders, requirements – Bituminous Emulsions and Cutbacks: Preparation, characteristics, uses and tests.

**MODULE 3: CHARACTERISTIC OF BITUMINOUS MIXES**

Bituminous Mixes: Mechanical properties – Resilient modulus, dynamic modulus and fatigue characteristics of bituminous mixes.

**MODULE 4: DESIGN OF BITUMINOUS MIX**

Weathering and Durability of Bituminous Materials and Mixes – Performance based Bitumen Specifications – Superpave mix design method.

**MODULE 5: DESIGN OF CEMENT CONCRETE MIX**

Cement Concrete for Pavement Construction: Requirements, design of mix for CC pavement, joint filler and sealer materials.

**TEXT BOOKS**


**REFERENCE BOOKS**

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<td>Describe the characteristics of pavement under various loading conditions</td>
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<td>Predict pavement behaviour under various stress and strain conditions</td>
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<td>3</td>
<td>Design flexible pavements based on various codal provisions.</td>
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<tr>
<td>4</td>
<td>Design cement concrete pavements as per IRC guidelines</td>
<td>1,2,3,4</td>
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<td>5</td>
<td>Design runways and taxiways for airfields.</td>
<td>1,2,3,4</td>
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Prerequisites: Nil

**MODULE 1: PAVEMENT COMPONENTS AND ITS FUNCTION**

Road Pavements and pavement layers - types, functions, choice Factors affecting design and performance of flexible and rigid pavements – Pavement design factors, loads – axle load distribution, ESWL, EWL, VDF due to varying loads and CSA, Subgrade support - CBR and plate bearing tests, Resilient Modulus, fatigue tests, permanent deformation Pavement material Characteristics, climatic, drainage and environmental factors, their effects and evaluation

**MODULE 2: BEHAVIOUR OF FLEXIBLE PAVEMENT**

Stresses and Deflection / strain in flexible pavements: Application of elastic theory, stresses, deflections / strains in single, two and three-layer system, Applications in pavement design. Problems.

**MODULE 3: DESIGN OF FLEXIBLE PAVEMENT**

Flexible pavement design: Empirical, semi empirical and theoretical design approaches, principle, advantages and application. Design steps by CBR method as per IRC, outline of other common design methods such as AASHTO and Asphalt Institute methods, Problems

**MODULE 4: DESIGN OF RIGID PAVEMENT**

Rigid pavement design: General design principle, Stresses in rigid pavements, stresses due to wheel loads and temperature variations, design of cement concrete pavements (joints and slab thickness) as per IRC guidelines. Design features of CRCP, SFRC and ICBP, Problems

**MODULE 5: AIRPORT PLANNING AND DESIGN**

Design of Airfields – Introduction to Runways, characteristics Design of airfields, Federal aviation authority, International Civil Aviation organization, taxiways design, lighting & marking Factors affecting design and performance of airport pavements

**TEXT BOOKS**


2. Specifications for” Road and Bridge works”, Fourth Revision, MoSRT&H(India), 2001

**REFERENCE BOOKS**
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**COURSE OUTCOMES**

The Students will be able to

1. Identify research problems and formulate the methodology. 2,4,7,10
2. Prepare effective research report based on literature. 2,4,7,10
3. Adopt suitable sampling techniques to analyse data and interpretation of results. 2,4,7,10
4. Utilize the knowledge gained on IPR and apply for innovative ideas and products. 2,4,7,10
5. Utilize the knowledge gained on patent rights for licensing and transfer of technology with new developments in IPR 2,4,7,10

Prerequisites: Nil

**MODULE 1: RESEARCH PROBLEM FORMULATION**

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

**MODULE 2: RESEARCH PROPOSAL AND ETHICS**

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

**MODULE 3: DATA ANALYSIS AND INTERPRETATION**

Classification of Data, Methods of Data Collection, Sampling, Sampling techniques procedure and methods, Ethical considerations in research Data analysis, Statistical techniques and choosing an appropriate statistical technique, Hypothesis, Hypothesis testing, Data processing software (e.g. SPSS etc.), statistical inference, Interpretation of results.

**MODULE 4: NATURE OF INTELLECTUAL PROPERTY**


**MODULE 5: PATENT RIGHTS AND NEW DEVELOPMENTS IN IPR**


**TEXT BOOKS**


**REFERENCES BOOKS**

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<tr>
<td>1</td>
<td>Conduct studies on volume, spot speed and delay.</td>
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<td>2</td>
<td>Analyse Environmental impact data for Noise and Air pollution studies</td>
<td>1,2,3,4,5</td>
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<td>3</td>
<td>Design dense bituminous mix and pavement quality concrete mix.</td>
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**LIST OF EXERCISE**

Conduct of the following surveys and design related to Transportation Engineering

- i) Volume count
- ii) Spot speed
- iii) Speed and delay studies
- iv) Origin and destination studies
- v) Physical inventory using total station survey equipment
- vi) Environmental impact – Noise studies and vehicular emission measurement
- Test on conventional bitumen, bitumen emulsion, cut back bitumen and modified bitumen.
- viii) Test on road aggregates
- ix) Tests on bituminous mixture.
- x) Design of dense bituminous mixes.
- xi) Design of pavement quality concrete mix.
### MINI PROJECT

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<td>1</td>
<td>Identify and work for the real life needs of the society</td>
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<td>2</td>
<td>Provide practical solutions to the societal problem</td>
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<td>Realize the importance of Engineering concepts and its relevant application</td>
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**Prerequisites:** Knowledge on Basic Core courses

- Students are expected to design and develop practical solutions to real life problems related to Industry and Research. Modern Software shall be used during the development and for simulation. The theoretical knowledge gained from the subject shall be applied to develop effective solutions.
- At the end of the course the student should submit a complete report of the work carried out.
## SEMESTER II

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### COURSE OUTCOMES

1. The Students will be able to
   1. Describe pavement construction operations, plans and equipment.  
   2. Design surface and subsurface drainage systems by identifying adequate materials.  
   3. Differentiate different road construction equipment and conduct pre-construction surveys and quality control tests.  
   4. Describe the specifications, construction and quality tests for different layers of granular base course and interlocking concrete block pavements  
   5. Identify measures for construction quality and maintenance of pavements.  

### Module 1: Components of Pavement

- Subgrade system, functions, requirements and sequence of construction operations. Plants and equipment for production of materials - crushers, mixers, bituminous mixing plants, cement concrete mixers – various types, advantages and choice.

### Module 2: Construction of Drainage

- Drainage – Assessment of drainage requirements for the road and design of various components, drainage materials, Construction of surface and subsurface drainage system and design of filter materials for roads. Drainage for urban roads.

### Module 3: Construction Equipments

- Road construction equipment – different types of excavators, graders, soil compactors / rollers, pavers and other equipment for construction of different pavement layers – their uses and choice.  
  Problem on equipment usage charges; Pre-construction surveys and marking on ground - Specifications and steps for the construction of road formation in embankment and cut, construction steps for granular sub-base, quality control tests.

### Module 4: Pavement Layers and Specifications

- Different types of granular base course – WMM, CRM, WBM; specifications, construction method and quality control tests. Different types of bituminous layers for binder and surface courses; their specifications (as per IRC and MORTH); construction method and quality control tests. Different types of sub-base and base course for cement concrete (CC) pavement and construction method.  
  Construction of cement concrete (PQC) pavements joints quality control during construction.  
  Construction details of interlocking concrete block pavements.

### Module 5: Quality Control and Maintenance

- Principle of construction planning, application of CPM and PERT (Problems not included) Road maintenance works – day to day and periodic maintenance works of various components of road works and road furniture. Preparation of existing pavement – patching, profile correction, Special measures to deal with reflection cracks in pavement layers, slipperiness of surface, etc. Special problems in construction & maintenance of hill roads, land slide, causes, investigation, and
preventive and remedial measures, protection of embankment and cut slopes.

**TEXT BOOKS**

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<tr>
<td>1</td>
<td>Freddy L Roberts, Prithvi S Kandhal et al, — <em>Hot Mix Asphalt Materials, mixture design and construction</em> - (2nd Edition), National Asphalt Pavement Association Research and Education Foundation, Maryland, USA.</td>
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<td>2</td>
<td>National Asphalt Pavement Association — <em>Hot Mix Asphalt Paving Hand book</em> - 5100 Forbes Boulevard, Lanham, Mary Land, USA</td>
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<td>Identify various bridge components and explain investigation stages.</td>
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<td>2</td>
<td>Differentiate various types and design of bridges foundations.</td>
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<tr>
<td>3</td>
<td>Design various structural components of bridges</td>
</tr>
<tr>
<td>4</td>
<td>Describe elements of pre-stressed bridges and design bearings</td>
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<tr>
<td>5</td>
<td>Explain process of construction and maintenance of bridges</td>
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**MODULE 1: INTRODUCTION** (9)

**MODULE 2: DESIGN OF SUBSTRUCTURE** (9)

**MODULE 3: DESIGN OF SUPERSTRUCTURE** (9)

**MODULE 4: ELEMENTS OF PRESTRESSED CONCRETE BRIDGE DESIGN** (9)
Size, prestressed force, eccentricity, design of cables, end blocks. Features and Design Consideration Of Bridges: Suspension bridges, cable stayed bridges and their components; bearings – types – design of rocker and roller bearings.

**MODULE 5: CONSTRUCTION AND MAINTENANCE** (9)

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<td>1</td>
<td>Understand the basic working principles of various equipment used for pavement evaluation</td>
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<td>2</td>
<td>Describe design aspects of overlay thickness of pavements</td>
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<td>3</td>
<td>Predict pavement performance</td>
<td>1,2,3,4</td>
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<td>4</td>
<td>Describe the different types of distresses and LCCA of pavements</td>
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<td>Identify suitable method for proper highway maintenance</td>
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**MODULE 1: PAVEMENT INVENTORIES AND EVALUATION: PURPOSES, FUNCTIONAL EVALUATION (9)**
Serviceability concepts, Distress types: Bituminous and Concrete pavements; Visual Rating; PSI; Methods of Measuring Roughness: Response type & Profile type; IRI: Quarter Car Model, Riding Number; Pavement Safety Evaluation: Skid Resistance, measurement of skid, skid resistance, Change of Skid resistance with time, traffic and climate; Control of Skid Resistance;Distress Modes - Cracking, Rutting etc.

**MODULE 2 : STRUCTURAL EVALUATION: PAVEMENT DEFLECTION (9)**

**MODULE 3: PAVEMENT MANAGEMENT SYSTEM (PMS) (9)**
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; Evaluating alternate strategies and Decision criteria based on Structural section, Material type, Construction policy, maintenance policy, Overlay and seal coat; Pavement performance prediction models; Techniques and Tools, Expert Systems and Pavement Management.

**MODULE 4: PAVEMENT MAINTENANCE MANAGEMENT (9)**
Components of maintenance management and related activities-Network and project level analysis; Budgeting; Prioritization Techniques and Formulation of Maintenance Strategies, Pavement Preservation. Pavement Life Cycle Cost Analysis (LCCA): Cost Components, Methods of LCCA-Components involved, Brief Description - Items considered - Case studies.

**MODULE 5: HIGHWAY MAINTENANCE (9)**
Need of Highway maintenance, methods of maintenance for flexible and rigid pavement layers; WBM, Bituminous and Cement Concrete pavements.

**TEXT BOOKS**
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<td>Haas and Hudson W.R. Pavement management systems - McGraw Hill</td>
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<td>Bridge and Pavement maintenance - Transportation Research</td>
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<td>Sargious, M.A. - Pavements and surfacing for highways and</td>
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<td>airports - Applied Science Publishers Ltd.</td>
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<td>Principles of Pavement Design, Yoder J. &amp; Witzac Mathew W.,</td>
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<td>Hand Book of Highway Engineering, Rober F.Baker, Editor, L.G</td>
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<td>Byrd D.Garit Mikle, Associate Edotor, Van Nostrand Reinhold</td>
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### COURSE OUTCOMES

The Students will be able to

1. Analyze geographic features using ArcGIS
2. Design of Highway Alignment
3. Design of Carriageway
4. Design of L/S and C/S of highways using Mx Road Software.

### ArcGIS

- Exercise 1: Exploring your data
- Exercise 2: Working with geographic features
- Exercise 3: Working with tables
- Exercise 4: Editing features
- Exercise 5: Working with map elements

### Mx Road

- Exercise 6: Introduction to Mx Road
- Exercise 7: Alignment design
- Exercise 8: Carriageway design
- Exercise 9: Earthworks calculation
- Exercise 10: Visibility
- Exercise 11: Sections and Volumes

### Lab Requirements:

- ArcGIS License for 10 systems
- Mx Road license for 10 systems
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### COURSE OUTCOMES

Students will be able to:

1. Independently study and investigate current research areas and share ideas while actively participating in presentation
2. Develop writing skills and prepare reports
3. Present and defend their research at seminars and conferences

**Prerequisites:** Nil

This work should consist of soft bound report on any technical topic of interest associated with the post graduate course and should be submitted in a standard format having the following contents.

1. Introduction
2. Literature survey
3. Theoretical contents
4. Field applications, case studies
5. Relevance to the present national and global scenario of construction industry
6. Strength and weaknesses of the particular area of seminar
7. R & D in the particular area
8. Benefit cost studies – feasibility studies
9. Vendors associated
10. Conclusions
11. References

Students should prepare a power point presentation to be delivered in fifteen minutes and should be able to answer questions asked in remaining five minutes. Where ever possible, the topic for the seminar may be decided on the mini project or the main project work to be done in semester II, III. The students will be evaluated through an end semester examination by a team of internal staff.
### SEMESTER III

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<td>Apply knowledge gained from the field work.</td>
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<td>2.</td>
<td>Utilise the experience gained from the field for professionalism in business sphere.</td>
<td>1,2,3,4,6,7, 8, 9,10,11</td>
</tr>
<tr>
<td>3.</td>
<td>Apply the skills gained in solving practical societal problems.</td>
<td>1,2,3,4,6,7, 8, 9, 10,11</td>
</tr>
</tbody>
</table>

**Prerequisites:** Nil

A student has to compulsorily attend Summer internship between second and third semester for a minimum period of two month preferably in an industry. In lieu of Summer internship, the student is permitted to register for project work under a faculty of the Institute and carry out the project for minimum period of two month. This can be a part of the major project. In both the cases, the internship report in the prescribed format duly certified by the faculty in-charge shall be submitted to the HOD. The evaluation will be done through presentation and viva. The course will have a weightage of one or two credits as defined in the respective curriculum.
The primary objective of the course ‘Project’ is to introduce the students to various sub-fields in Highway Engineering. It is aimed at exposing the students to current development and research activities in the above-mentioned fields. The students are also trained to gather in-depth information on specified areas or topics. The students are made proficient to make proper technical documentation on the selected topic. Moreover, the course would also provide training to students to make effective technical presentations.
## CURRICULUM AND SYLLABUS

### SEMESTER IV

<table>
<thead>
<tr>
<th>COURSE TITLE</th>
<th>PROJECT WORK PHASE-II</th>
<th>CREDITS</th>
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<th>COURSE OUTCOMES</th>
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<tbody>
<tr>
<td>1.</td>
<td>Students will be able to describe a process that has previously been unexplained, difficult or poorly/partially understood and to conduct an active, systematic process of inquiry</td>
<td>1,2,3,4,5, 6,7,8,9, 10,11</td>
</tr>
<tr>
<td>2.</td>
<td>Demonstrate ability to analyse and investigate new or advanced areas of research.</td>
<td>1,2,3,4,5, 6,7</td>
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<tr>
<td>3.</td>
<td>Develop the essential personal, organisational, management, theoretical and research skills to become independent researchers.</td>
<td>6,7,8,9, 10,11</td>
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<tr>
<td>4.</td>
<td>Prepare professional documentation of research work carried out.</td>
<td>8</td>
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**Prerequisites: PROJECT PHASE I**

This course is a continuation of the work initiated in third semester and the student is expected to present two reports at intermediate stages, as well as prepare and submit a consolidated report of the work undertaken in the third and fourth semester. The student has to defend the thesis on his research work at the end of the fourth semester.
# Electives

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<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Highway Traffic Analysis and Design</td>
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**Course Code**: CED3721  
**Course Category**: ELE  
**L-T-P**: 3-0-0  
**CIA**: 50%  
**ESE**: 50%  
**Learning Level**: BTL3

## Course OUTCOMES

The students will be able to:

1. Understand the basic concepts of Traffic Engineering  
2. Remember Traffic volume studies, Origin Destination studies  
3. Design Highway Cross sectional elements  
4. Design at grade Intersections, rotaries and Traffic signals

**Prerequisites**:

### Module 1: Basic Concepts of Traffic Engineering (9)


### Module 2: Surveys and Studies in Traffic Engineering (9)

Traffic volume studies, origin destination studies, speed studies, travel time and delay studies, Parking studies, Accident studies.

### Module 3: Geometric Design of Highways (9)


### Module 4: Design of Intersections (9)


### Module 5: Highway Infrastructure and Safety Audit (9)


## Text Books


## Reference Books

1. AASHTO A Policy on Geometric Design of Highway and Streets  
## CURRICULUM AND SYLLABUS

### COURSE DETAILS

<table>
<thead>
<tr>
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### LEARNING LEVEL

| BTL2 |

### COURSE OUTCOMES

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<td>1</td>
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<td>3</td>
<td>1,2,3,4</td>
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<td>4</td>
<td>1,2,3,4</td>
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<tr>
<td>5</td>
<td>1,2,3,4</td>
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</table>

**Prerequisites:** Nil

### MODULE 1: INTRODUCTION


### MODULE 2: CONTRACT MANAGEMENT

Fundamentals of Contracting - Types of Structure of Contracts - Item rate contract, Lump sum contract, Cost plus etc. - advantages and disadvantages - Important clauses of Contracts, Laws related to contracts - Tender procedures, preparation of Tender schedule, Receipt of Tenders, essential arts of contract documents - Evaluation of tenders, contract negotiation and award of works, Types of contract payment - Settlement of disputes, arbitration and commissioning of project, risk factors in contracts.

### MODULE 3: PROJECT PLANNING AND CONTROL

Preliminary Planning - estimates - work break down structure (WBS) - Time Management and Scheduling - Bar chart/Gantt chart - Advantages Network methods - Activity on arrow (AoA) - Activity on node (AoN) - Coordination Model - Network diagram - Critical Path Method - network schedule - Forward pass - Backward pass - calculation critical path - Floats/slacks - importance - Types of floats / Calculation of floats - PERT - Probability - three time estimates, expected time, standard deviation, variance - critical path - Precedence Network Method, Project monitoring - updating - Target Schedule - Time cost Trade off - Crashing, optimum cost, time

### MODULE 4: CONSTRUCTION EQUIPMENT

Topics to be Covered - Hours Introduction, Factors affecting selection of Equipment, Types of Equipment - Equipment costs, Owning and operating costs, Owning, Renting and leasing - Earth moving Equipment - Dozers, Loaders, Excavators, Trucks, Graders, Comparators - Concrete Construction Equipment - Mixers, Batch Plants, Concrete Pumps, Transits Mixers, Vibrators, Finishing Equipments - Lifting and Hoisting Equipment - Pullers and Winches, Derricks, Craves, Builder’s Hoist - Road Construction Equipment, Pumps, Compressors, Pulling Equipment.

### MODULE 5: FINANCIAL MANAGEMENT

Account Management - basic concepts - Accounting System - Book Keeping - Depreciation - Project cost estimates - Reasons for cost overruns - Financial Management - concept of valuation - Net present value -
**CURRICULUM AND SYLLABUS**

Internal rate of return Project cost control -objective -forecasting -direct and indirect cost.

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<tr>
<th>REFERENCE BOOKS</th>
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<tbody>
<tr>
<td>2 Dr.Mahesh Varma, “Construction Equipment and its Planning and Application”, Metro –Politran Book Company, New Delhi, 1983</td>
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<td>The Students will be able to</td>
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<tr>
<td>1</td>
<td>Understand the Requirements of ground improvements</td>
<td>1,2,3,4</td>
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<tr>
<td>2</td>
<td>Apply soil stabilization techniques,</td>
<td>1,2,3,4</td>
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<tr>
<td>3</td>
<td>Analyse the suitability of prefabricated vertical drains, dry powdered polymers etc.</td>
<td>1,2,3,4</td>
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<tr>
<td>4</td>
<td>Explain concepts of soil Reinforcement</td>
<td>1,2,3,4</td>
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<tr>
<td>5</td>
<td>Evaluate geo synthetics based on research and development.</td>
<td>1,2,3,4</td>
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Prerequisites:

**MODULE 1: INTRODUCTION** (9)

Engineering properties of soft – weak and compressible deposits – problems associated with weak deposit – Requirements of ground improvements – introduction to engineering ground modification, need and objectives.

**MODULE 2 : SOIL STABILIZATION** (9)


**MODULE 3: RECENT GROUND IMPROVEMENT TECHNIQUES** (9)


**MODULE 4: SOIL REINFORCEMENT** (9)


**MODULE 5: GEO-SYNTHETICS** (9)


**TEXT BOOKS**
**CURRICULUM AND SYLLABUS**

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<tr>
<td>2</td>
<td>Ground Improvement Techniques</td>
<td>Purushotham Raj</td>
<td>Laxmi Publications, New Delhi</td>
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<td>PO</td>
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</table>

The Students will be able to
1. Assess pavement performance 1,2,3,4
2. Evaluate pavement deterioration 1,2,3,4
3. Generate alternate design strategies for pavements 1,2,3,4
4. Implement pavement management system in real time. 1,2,3,4

Prerequisites: Nil

**MODULE 1: PAVEMENT MAINTENANCE & MANAGEMENT** (9)
Pavement Maintenance & Management Process: Application of system concepts to pavement management, pavement management levels-Network & Project level, functions - Data needs, Pavement life cycle, assessment of pavement performance, evaluation of pavement structural capacity, distress & safety, combined measures of pavement quality, data management

**MODULE 2: PAVEMENT DETERIORATION, REHABILITATION AND MAINTENANCE** (9)

**MODULE 3: PAVEMENT DESIGN** (9)
Project Level Design: Framework for pavement design, characterization of physical design inputs, basic structural response models – variability, reliability and risk – generating alternate design strategies, rehabilitation design procedures, Overlay design, economic evaluation of alternate pavement design strategies – selection of optimal design strategy.

**MODULE 4: PAVEMENT MANAGEMENT SYSTEM** (9)
Implementation: Major steps in implementing PMS – pavement construction management & pavement maintenance management – information’s, research needs – cost and benefit of pavement management – future directions and need for innovations in pavement management, HDM applications

**MODULE 5: CASE STUDIES** (9)
Case Studies -Pavement Management and Maintenance

**TEXT BOOKS**


**REFERENCE BOOKS**

1. Pavement Management for Airports, Roads, and Parking Lots, Shahin, Mo Y., Springer publication
# CURRICULUM AND SYLLABUS

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<tr>
<td>CO</td>
<td>COURSE OUTCOMES</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Understand admixtures and its properties,</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>2</td>
<td>Remember the measurement of Workability by different tests,</td>
<td>1,2,3,4</td>
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<tr>
<td>3</td>
<td>Analyze the relation between compressive and tensile strength,</td>
<td>1,2,3,4</td>
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<tr>
<td>4</td>
<td>Evaluate the durability of concrete under various climatic conditions</td>
<td>1,2,3,4</td>
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<td>Prerequisites : Nil</td>
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## MODULE 1: CEMENT AND ADMIXTURES (9)

## MODULE 2: AGGREGATES AND ITS PROPERTIES (9)
- Classifications of aggregates - particle shape and texture - bond, strength and other mechanical properties of aggregate - specific gravity, bulk density, porosity, absorption and moisture content of aggregate - bulking of sand - deleterious substance in aggregate – soundness of aggregate - alkali-aggregate reaction - thermal properties - sieve analysis - fineness modulus - grading curves - grading of fine and coarse aggregates - gap graded aggregate – maximum aggregate size – combined a grading – BIS grading.

## MODULE 3: FRESH CONCRETE AND HARDENED CONCRETE (9)

## MODULE 4: ELASTICITY, SHRINKAGE AND CREEP (9)

## MODULE 5: CONCRETE MIX DESIGN AND SPECIAL CONCRETE ISSUES (9)
**CURRICULUM AND SYLLABUS**


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<th>Title and Edition</th>
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<tr>
<td>1</td>
<td>IS10262-2009 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998</td>
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<td>3</td>
<td>Shetty, M.S, &quot;Concrete Technology&quot;, S.Chand and Company Ltd, New Delhi, 2003</td>
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## COURSE TITLE
TRANSIT SYSTEM PLANNING

## CREDITS
3

## COURSE CODE
CED3726

## COURSE CATEGORY
ELE

## CIA
50%

## LEARNING LEVEL
BTL3

## COURSE OUTCOMES

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<td>1 Evaluate the performance of Public Transit Infrastructure Planning,</td>
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<tr>
<td>2 Analyse Operation and Management of Transit system,</td>
<td>1,2,3,4</td>
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<tr>
<td>3 Understand the need for Integrated Approach,</td>
<td>1,2,3,4</td>
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<tr>
<td>4 Apply the recent trends in Mass Transportation Planning and Management.</td>
<td>1,2,3,4</td>
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## Prerequisites :

### MODULE 1: TRANSIT SYSTEM AND ISSUES
(9)


### MODULE 2 : PUBLIC TRANSIT SYSTEM
(9)


### MODULE 3: BUS TRANSIT PLANNING AND SCHEDULING
(9)


### MODULE 4: RAIL TRANSIT TERMINALS AND PERFORMANCE EVALUATION
(9)


### MODULE 5: IMPACT OF MASS TRANSPORT
(9)


## TEXT BOOKS

1. Michael J. Bruton, An Introduction to Transportation Planning, Hutchinson.

## REFERENCE BOOKS

1. F.D. Hobbs, Traffic Planning and Design, Poargamon Oress
# CURRICULUM AND SYLLABUS

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<tr>
<td>4</td>
<td>Traffic Engineering and Transport Planning, L.R. Kadiyali, Khanna publishers, 2011.</td>
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# CURRICULUM AND SYLLABUS

## COURSE TITLE
ACCIDENT ANALYSIS AND SAFETY AUDIT

## CREDITS
3

## COURSE CODE
CED3727

## COURSE CATEGORY
ELE

## L-T-P
3-0-0

## CIA
50%

## ESE
50%

## LEARNING LEVEL
BTL3

### COURSE OUTCOMES (PO)

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<tbody>
<tr>
<td>1. Understand the role of NGO</td>
<td></td>
</tr>
<tr>
<td>2. Analyse the causes of road accidents</td>
<td></td>
</tr>
<tr>
<td>3. Apply Accident Prediction Models</td>
<td></td>
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<tr>
<td>4. Evaluate road safety audit in existing roads.</td>
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</table>

### Prerequisites:
Nil

## MODULE 1: FACTORS INFLUENCING ACCIDENTS (9)


## MODULE 2: ACCIDENT ANALYSIS (9)

Collision Diagram – Preparation, Spatial Analysis of Accidents – Methods - GIS in Accident Analysis - Black Spot, Black Route and Area Identification.

## MODULE 3: EVALUATION OF ACCIDENT PREDICTION MODELS (9)


## MODULE 4: SAFETY AUDIT (9)


## MODULE 5: ACCIDENT INVESTIGATION (9)


### TEXT BOOKS


### REFERENCE BOOKS


## CURRICULUM AND SYLLABUS

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<td>COURSE OUTCOMES</td>
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<tr>
<td>The Students will be able to</td>
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</tr>
<tr>
<td>1</td>
<td>Describe various models of urban transportation system</td>
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<tr>
<td>2</td>
<td>Explain travel demand</td>
<td>1,2,3,4</td>
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<tr>
<td>3</td>
<td>Explain elements of urban transportation planning</td>
<td>1,2,3,4</td>
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<tr>
<td>4</td>
<td>Conduct transportation surveys</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>5</td>
<td>Apply growth factor methods in urban transportation planning</td>
<td>1,2,3,4</td>
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<tr>
<td>Prerequisites : nil</td>
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### MODULE 1: INTRODUCTION TO URBAN TRANSPORTATION PLANNING (9)

Introduction to Urban transportation planning; systems approach to Urban transportation planning; types of models

### MODULE 2: TRAVEL DEMAND (9)

Concept of travel demand and supply; socio-economic, Urban land use, network, and transport system

### MODULE 3: ELEMENTS OF URBAN TRANSPORT PLANNING (9)

Characteristics affecting urban transportation planning; study area definition, zoning principles, cordon and screen lines, data collection through primary and secondary sources

### MODULE 4: TRANSPORTATION SURVEYS (9)

The transportation study area definition; division into traffic zones; network identification and coding; types of travel and characteristics of various surveys; home interview; roadside survey; goods, mass transit and intermediate public transport surveys; sampling and expansion factors; accuracy checks, screen line checks, consistency checks

### MODULE 5: TRAVEL FORECASTING (9)

Growth factor methods and urban transportation planning system; growth factors; average growth factor method and Furness method

### TEXT BOOKS


### REFERENCE BOOKS

### CURRICULUM AND SYLLABUS

<table>
<thead>
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</table>

#### The Students will be able to

1. Design elements such as sight distance, horizontal curvature, super elevation, grades, visibility on vertical curves etc.
2. Apply go green concepts for pavements.
3. Remember climate suitability for concrete materials,
4. Apply quality control tests at different stage of road construction.

**Prerequisites:** Nil

### MODULE 1: INTRODUCTION

Importance of Rural roads, Classification of rural roads, Terrain classification, Socio-economic impact of rural roads. Planning and Alignment: Data base for master plan, Concept of network planning, Rural Roads plan, Road alignment, Governing factors for route selection, Factors controlling alignment, Special considerations while aligning hill roads, Surveys, Detailed project report, Environmental issues.

### MODULE 2: GEOMETRIC DESIGN

Introduction, Design speed, Basic principles of geometric design, Elements, Horizontal and vertical alignment, Alignment compatibility, Lateral and vertical clearances. Road Materials: General, Soil and material surveys, Soil as road construction material, Stabilized soils, Aggregates for pavement courses, New materials and stabilizers, Materials for bituminous construction, Materials for semi-rigid and rigid pavement, Materials for special pavements Climatic suitability of concrete materials.

### MODULE 3: PAVEMENT DESIGN

Introduction, Design parameters, Pavement components, Design of flexible pavement, Design of semi-rigid pavement, Design of rigid pavement, Design of special pavements, Drainage and Shoulders Specifications and Construction: General, Selection of construction materials and methodology, Earthwork, Sub-base, Base course, Bituminous constructions, Semi-rigid pavement construction, Concrete pavements, Construction of special pavements, Equipment required for different operations.

### MODULE 4: GREEN ROAD CONCEPT AND USE OF WASTE MATERIALS


### MODULE 5: MAINTENANCE

General, Distresses/defects in pavements, Definitions of maintenance activities, Inventory of road and inspection, Types of maintenance, Classification of maintenance activities, Maintenance norms, maintenance cost.

### TEXT BOOKS
**CURRICULUM AND SYLLABUS**

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**REFERENCE BOOKS**

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<tr>
<td>2</td>
<td>Central Road Research Institute ‘Various Reports on Use of Waste Materials’</td>
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<td>TRANSPORTATION PLANNING</td>
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**COURSE OUTCOMES**

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<tr>
<th>CO</th>
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<tbody>
<tr>
<td>1</td>
<td>Understand the Concepts of four stage modeling,</td>
<td>1,2,3,4</td>
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<tr>
<td>2</td>
<td>Remember the classification of Trips based on generation and distribution,</td>
<td>1,2,3,4</td>
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<td>3</td>
<td>Analysis of Network in modeling,</td>
<td>1,2,3,4</td>
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<tr>
<td>4</td>
<td>Evaluate Land Use Transport Models (LUT).</td>
<td>1,2,3,4</td>
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**Prerequisites**: Nil

**MODULE 1: PRINCIPLES OF URBAN TRANSPORT PLANNING** (9)

Urban Transportation Planning - Goals and objectives - Hierarchical levels of transportation planning - Forecast - Implementation - Constraints. UTP survey – Inventory of land use.

**MODULE 2: FOUR STAGE MODELING PROCESS** (9)

Trip generation - Trip classification - productions and attractions - Multiple regression models - Category analysis - Trip production models - Trip distribution models – Linear programming approach.

**MODULE 3: MODELLING PROCESS AND ANALYSIS** (9)


**MODULE 4: LANDUSE TRANSPORT MODEL** (9)


**MODULE 5: EVALUATION OF LUT** (9)

Preparation of alternative plans - Evaluation techniques - Plan implementation - Monitoring - Financing of Project – Case studies.

**TEXT BOOKS**


**REFERENCE BOOKS**

### CURRICULUM AND SYLLABUS

<table>
<thead>
<tr>
<th>COURSE TITLE</th>
<th>INTELLIGENT TRANSPORTATION SYSTEMS</th>
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#### COURSE OUTCOMES

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<tbody>
<tr>
<td>1. Understand the historical background of ITS</td>
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<tr>
<td>2. Apply the ITS Data collection Techniques,</td>
<td>1,2,3,4</td>
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<tr>
<td>3. Analyze ITS implementation in developing countries.</td>
<td>1,2,3,4</td>
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#### Prerequisites:

##### MODULE 1: INTRODUCTION TO INTELLIGENT TRANSPORTATION SYSTEMS (ITS) (9)


##### MODULE 2: TELECOMMUNICATIONS IN ITS (9)


##### MODULE 3: FUNCTIONAL AREAS (9)


##### MODULE 4: ITS USER NEEDS AND SERVICES (9)


##### MODULE 5: AUTOMATED HIGHWAY SYSTEMS (9)

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.


#### REFERENCE BOOKS

**CURRICULUM AND SYLLABUS**

<table>
<thead>
<tr>
<th>COURSE TITLE</th>
<th>TRANSPORT ECONOMICS AND MANAGEMENT</th>
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**COURSE OUTCOMES**

1. **The Students will be able to**
   - Design Depots & Terminals
   - Analyze the projects economically,
   - Understand the importance of Vehicle Operating Cost,
   - Evaluate various transport projects economically.

**Prerequisites : Nil**

<table>
<thead>
<tr>
<th>MODULE 1: TRANSPORT PLANNING AND SCHEDULING (9)</th>
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<tbody>
<tr>
<td>Motor Vehicles Act - statutory provision for road transport and connected organizations. Route scheduling, Freight transport, Vehicle scheduling, Optimum fleet size, Headway control strategies, Crew scheduling.</td>
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<tr>
<th>MODULE 2 : DESIGN OF TRANSPORT INFRASTRUCTURE (9)</th>
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<tbody>
<tr>
<td>Depots and Terminals - Principles and types of layout, Depot location, Twin depot concept, Crew facilities. Design of parking facilities – Bus terminal, bus stops and bus bays.</td>
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<table>
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<tr>
<th>MODULE 3: TRANSPORT DEMAND SUPPLY CONCEPT (9)</th>
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<tbody>
<tr>
<td>Transportation costs - Supply and demand - elasticity of demand; Supply of transport services - Economics of traffic congestion - Pricing policy-Vehicle operating costs – Fuel costs - Maintenance and spares - Depreciation - Crew costs - Value of travel time savings - Accident costs.</td>
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<th>MODULE 4: ECONOMIC EVALUATION (9)</th>
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<tbody>
<tr>
<td>Economic analysis of projects - Methods of evaluation - Cost-benefit ratio, first year rate of return, net present value, and internal-rate of return methods; Indirect costs and benefits of transport projects</td>
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<tr>
<th>MODULE 5: HIGHWAY FINANCING (9)</th>
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</table>

**TEXT BOOKS**


**REFERENCE BOOKS**

3. CRRI, Road User Cost Study in India, New Delhi, 1982
<table>
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<tr>
<th>COURSE TITLE</th>
<th>GIS AND REMOTE SENSING APPLICATIONS IN TRANSPORTATION ENGINEERING</th>
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<tbody>
<tr>
<td>1. Understand the Components of Remote Sensing, 1,2,3,4</td>
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<tr>
<td>2. Analyse the Raster and Vector Datas, 1,2,3,4</td>
</tr>
<tr>
<td>3. Apply Buffering &amp; Overlaying Techniques, 1,2,3,4</td>
</tr>
<tr>
<td>4. Analyze Transportation Engineering Problems using Aerial Photography and Satellite Imageries 1,2,3,4</td>
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</table>

Prerequisites: Nil

**MODULE 1: BASIC CONCEPT OF REMOTE SENSING** (9)

**MODULE 2: COMPONENTS OF REMOTE SENSING** (9)
Basic Concept and Components – Hardware, Software – Data Spatial and non-spatial – Georeferencing – Map Projection – Types of Projection – Simple Analysis – Data retrieval and querying

**MODULE 3: DATA ANALYSIS** (9)

**MODULE 4: GIS IN TRANSPORTATION ENGINEERING** (9)
Highway and Railway Alignment, location of transport terminals and roadside facilities, bus stops – Route optimization – Bus route rationalization – Accident analysis – Applications of Aerial Photography and Satellite Imageries

**MODULE 5: INTEGRATION OF GIS** (9)
GIS as an integration technology – Integration of GIS, GPS and Remote Sensing Techniques – Advanced Traveller Information System (ATIS) – Automatic Vehicle Location System (AVLS)

**TEXT BOOKS**

**REFERENCE BOOKS**
1. Burrough P.A, Principles of GIS for Land Resources Assessment, Oxford publication
<table>
<thead>
<tr>
<th>COURSE TITLE</th>
<th>ROAD SAFETY ENGINEERING &amp; MANAGEMENT</th>
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**COURSE OUTCOMES**

1. Understand the fundamentals of traffic safety analysis, 1,2,3,4
2. Analyse Accident data 1,2,3,4
3. Remember the concepts of road safety in urban transport, 1,2,3,4
4. Apply crash reduction techniques, 1,2,3,4
5. Design of urban Infrastructure considering safety aspects. 1,2,3,4

**Prerequisites**: Nil

**MODULE 1: TRAFFIC SAFETY ANALYSIS** (9)


**MODULE 2: ACCIDENT ANALYSIS** (9)

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.

**MODULE 3: ROAD SAFETY IN PLANNING AND GEOMETRIC DESIGN** (9)

Vehicle And Human Characteristics, RoadDesign 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.

**MODULE 4: URBAN INFRASTRUCTURE DESIGN** (9)

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.

**MODULE 5: TRAFFIC MANAGEMENT SAFETY AUDIT** (9)

# CURRICULUM AND SYLLABUS

## TEXT BOOKS

<table>
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<th>Publisher</th>
<th>Year</th>
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<tbody>
<tr>
<td>1</td>
<td>Traffic Engineering and Transportation Planning</td>
<td>L.R. Kadiyali</td>
<td>Khanna Publishers</td>
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<tr>
<td>2</td>
<td>Fundamentals of Transportation Engineering</td>
<td>C.S. Papacostas</td>
<td>Prentice Hall India</td>
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## REFERENCE BOOKS

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<td>1</td>
<td>Transportation Engineering – An Introduction</td>
<td>C. Jotinkhisty, B. Kent Lall</td>
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<td>2</td>
<td>Fundamentals of Traffic Engineering</td>
<td>Richardo G Sigua</td>
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<td>3</td>
<td>Handbook of Road Safety measures, second Edition</td>
<td>Rune Elvik, Alena Hoye, TrulsVaa,</td>
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<td></td>
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<td>Michael Sorenson</td>
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<td>4</td>
<td>Road Safety by National Cooperative Highway Research Programme</td>
<td>NCHRP Synthesis 336.A</td>
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<td>COURSE TITLE</td>
<td>COMPUTER SIMULATION APPLICATIONS IN TRANSPORTATION ENGINEERING</td>
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**COURSE OUTCOMES**

1. Understand the Simulation Concepts
2. Simulate queuing system,
3. Schedule events using GPSS processor
4. Prepare statistical reports
5. Validate simulation models.

**Prerequisites**: Nil

**MODULE 1: TRANSPORTATION SYSTEM APPROACH** (9)

Introduction to systems approach – Typical transportation systems – Mathematical models. Fundamentals of simulation – Monte Carlo method – Analog and digital simulation Continuous and discrete models – Simulation languages – Introduction to CSMP.

**MODULE 2: CONCEPTS OF ARRIVAL PATTERN** (9)


**MODULE 3: EVENT SCHEDULING** (9)

Creating and moving transactions – Queues and facilities – Event scheduling – Internal logic of GPSS processor – Program control statements.

**MODULE 4: STATISTICAL REPORT PREPARATION** (9)


**MODULE 5: SIMULATION AND VALIDATION** (9)


**TEXT BOOKS**

2. GPSS/PC, User Manual, Minuteman Software, USA.