SIDDHARTHA
ACADEMY OF HIGHER EDUCATION
A DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act, 1956)

SCHEME OF INSTRUCTIONS
Ph.D. PROGRAMME
CIVIL ENGINEERING

Ph.D. Programs Applicable for the batch of students admitted from the Academic Year 2024 - 25

VELAGAPUDI RAMAKRISHNA
SIDDHARTHA SCHOOL OF ENGINEERING

Kanuru, Vijayawada - 520 007, Andhra Pradesh
www.vrsiddhartha.ac.in

INSTITUTION VISION

To be a Centre of Excellence in Education, Innovation and Research with Global presence in Arts, Science, Technology, Medicine, Management, Legal Studies and Social Studies in enriching the frontier areas of National and International Importance.

INSTITUTION MISSION

- To create a transformative educational experience for students focused on problem solving skills; communication abilities, and interpersonal relations and leadership.
- To cultivate a vibrant university community for attracting and retaining diverse, world-class talent creating a collaborative environment open to the free exchange of ideas where research, creativity, innovation and entrepreneurship can flourish and ensuring individuals to achieve their full potential.
- To impact society in a pragmatic manner - regionally, nationally and globally - by engaging with industry, outstanding national and international universities and research organizations.
- To be a global University that nurtures excellence in education and innovation for creating a knowledgeable society.

DEPARTMENT VISION

To achieve excellence and quality in civil engineering education, research, innovation, capacity building & training, and industry-academia collaboration, thus contributing to sustainable infrastructure development that serves the society.

DEPARTMENT VISION

- *To foster quality education, research, innovation, professional engagement, entrepreneurship and outreach activities through collaboration with Industry and academia,* addressing real-world infrastructure challenges.
- *To provide ethical values, leadership, environmental sustainability and lifelong learning through an interdisciplinary approach that encourages social responsibility and professional growth in Civil Engineering.*

DOCTOR OF PHILOSOPHY (Ph.D.)
REGULATIONS (2024-2025)

Ph.D. Regulations 2024

1. Ph.D. – Category of Admission

1.1 Full-Time Category

i) With Fellowship:

- Fellowships will be provided as per university norms.
- The Full-Time category candidates should work on the campus throughout their research program with or without fellowship.

ii) Without Fellowship:

a) Sponsored Candidates:

Candidates with an excellent academic record and sponsored by institutions / research organizations / industries can also join the doctoral program.

b) Self-Financed:

Candidates with an excellent academic record and self-financed candidates are eligible under this category.

1.2 Part-Time Category

- Sponsored candidates working in institutions / research organizations / industries are eligible without fellowship.
- They have to fulfill the norms of the university to complete the Ph.D. program.

2. Eligibility

2.1 Ph. D in Engineering

1. 10+2+4+2 pattern of studies or equivalent in Engineering Degree / 10+2+5 year Integrated M.Tech Programme, Integrated M.S. Programme in Engineering.
   MCA & M.Tech (CSE / IT) / M. Sc. (Maths / Computer Science) & M.Tech (CSE / IT) are also eligible for Ph.D. in Computer Science and Allied Engineering.
2. Candidates with a Master's in Engineering / Technology or M.S. by Research with a minimum of 60% (CGPA of 6.5/10) aggregate marks either in their Bachelor's or Master's Programme for general category (for SC/ST/OBC 55% aggregate or CGPA of 6.0/10 either in their Bachelor's or Master's Programme).
3. Candidates with MCA & M.Tech (CSE / IT) / M. Sc. (Maths / Computer Science) & M.Tech (CSE / IT) with a minimum of 60% (CGPA of 6.5/10) aggregate marks

either in their MCA / M.Sc. or M. Tech (for SC/ST/OBC 55% aggregate or CGPA of 6.0/10 either in their MCA / M.Sc. or M. Tech).

4. Preference may be given to candidates with valid GATE score for selection.
5. A valid SRCAT score is mandatory for both full-time and part-time admissions.
6. The candidates with valid score in UGC NET / APSET / APRCET are exempted from SRCAT (Siddhartha Research Common Admission Test).
7. If case of any candidate working in government recognized R&D institutions at Scientist Level with minimum two years of experience, the candidate may be exempted from SRCAT based on the recommendations of Vice-Chancellor.

2.2 Ph.D. in Mathematics / Physics / Chemistry / English / Social Science / Management

1. 10 + 2 + 3 + 2 or equivalent in Sciences / Humanities / Management.
2. The candidates under the above category are admitted under the part-time Programme and are not eligible for fellowship.
3. Candidates with a minimum of 60% aggregate marks in their Bachelor's or Master's in the relevant discipline or CGPA of 6.5/10 for the general category (for SC / ST / OBC 55% aggregate or CGPA of 6.0/10).
4. Preference may be given to candidates with a valid GATE score for selection.
5. A valid SRCAT score is mandatory for both full-time and part-time admissions.
6. The candidates with valid score in UGC NET / APSET / APRCET are exempted from SRCAT (Siddhartha Research Common Admission Test).
7. If case of any candidate working in government recognized R&D institutions at Scientist Level with minimum two years of experience, the candidate may be exempted from SRCAT based on the recommendations of Vice-Chancellor.

3. Selection Procedure

3.1 Admission notification shall be published in leading newspapers.

3.2 All candidates should register for admission through the prescribed URL: https://admissions.vrsiddhartha.ac.in

3.3 The schedule of admission test and test pattern including the syllabus will be intimated to all registered candidates after the last date of registration.

3.4 It is mandatory for all candidates who fulfill the eligibility criteria prescribed, shall appear for the SRCAT (Siddhartha Research Common Admission Test).

3.5 For those candidates who qualify UGC NET / APSET / APRCET, the entrance test may be waived off.

3.6 Preference may be given to candidates with valid GATE score for selection.

3.7 In the case of the candidates with a valid SRCAT / APRCET score, the selection is done with the following weightage of marks. Score in the entrance examination (40% weightage), PG Degree marks (20% weightage), Research Plan (10% weightage), and Personal Interview (30% weightage).

3.8 In the case of the candidates with a valid UGC NET / APSET score, the selection is done with the following weightage of marks. Score in the entrance examination (70% weightage) and Personal Interview (30% weightage).

3.9 Eligible candidates will be screened by a Departmental Selection Committee constituted by the Vice-Chancellor.

3.10 The Shortlisted candidates should appear for a personal interview on the University Premises and submit their research plan.

3.11 A merit list will be submitted for approval by the Departmental Selection Committee through the Dean (R &D) to the Vice-Chancellor.

3.12 The selected candidates will be intimated through e-mail.

4. Orientation Program

Immediately on admission, the students are expected to undergo an orientation program in the concerned School / Department. This program is intended to familiarize the new students with research activities in the School / Department.

5. Research Supervisor

5.1 At the end of the orientation program, each research scholar will be assigned a Research Supervisor by the concerned Head of the Department / School, keeping the following in view.

1. The preference and research interests of the student.
2. The interest of the concerned faculty member and his / her availability.

The student will choose the topic of his / her research based on the advice of the Research Supervisor.

5.2 There shall not be more than two Supervisors for a research scholar.

In areas where there is not enough expertise at the University to supervise a research scholar on a particular topic, an expert from the R & D Lab / Institutions / Industry may be appointed as a Research Supervisor (Co-Supervisor) after due approval by the appropriate authority at the University. Even in such cases, there will be a Research Supervisor identified from within the University. A detailed

biodata of the proposed Research Supervisor (Co-Supervisor) should be enclosed along with the request.

6. Eligibility Criteria for Research Supervisor / Co-Supervisor

Any faculty member of the University who satisfies the following requirements is eligible for the appointment as a Research Supervisor / Co-Supervisor.

6.1 Any regular Professor / Associate Professor / Assistant Professor of the University, with at least two SCI indexed publications and with a minimum of two years of teaching experience post Ph.D. degree may be recognized as Research Supervisor / Co-Supervisor.

6.2 Only a full-time regular faculty of the University can act as a Research Supervisor / Co-Supervisor.

6.3 Adjunct faculty are not permitted to be Research Supervisors except being co-supervisors.

6.4 The allocation of a Research Supervisor for a selected research scholar shall be decided by the Department concerned depending on the number of scholars per Research Supervisor, the available specialization among the Supervisors, and the research interests of the scholars as indicated by them at the time of interview/viva voce.

6.5 In the case of topics that are inter-disciplinary and where the Department concerned feels that the expertise in the Department has to be supplemented from outside, the Department may appoint a Research Supervisor from the Department itself, who shall be known as the Research Supervisor, and a Co-Supervisor from outside the Department of the University or outside Institutions / Organizations, such terms and conditions as may be specified and agreed upon by the consenting Institutions / Organizations.

6.6 A Research Supervisor/Co-Supervisor who is a Professor cannot supervise more than eight (8) Ph.D. scholars at any given point of time (including co-supervision).

6.7 An Associate Professor as a Research Supervisor can supervise up to a maximum of six (6) Ph.D. scholars (including co-supervision)

6.8 An Assistant Professor as a Research Supervisor can supervise up to a maximum of four (4) Ph.D. scholars (including co-supervision).

6.9 At any point of time the total number of candidates under research supervisor shall not exceed the number as prescribed above including the candidates under co-supervision.

6.10 The Research Supervisor should declare the number of Ph.D. scholars registered with him / her periodically to the University. He/she cannot increase the number by using recognition from multiple universities.

6.11 In case any research supervisor resigns from his job, it is his/her responsibility to suggest a list of three faculty members who are experts in the same domain. The head of the department will review the list of recommended faculty members and select one as the new research supervisor to replace the resigning supervisor in consultation with RAC members.

6.12 University faculty after superannuation, if they are re-appointed in the parent University as a contract or honorary or distinguished or emeritus professor, may continue as Research Supervisors till the age of 70. The university, after considering the research track record and fitness of such superannuated faculty to supervise scholars, may decide on his/her continuation as a Research Supervisor without financial commitment.

6.13 Faculty who resigned and left the University will forfeit his / her claim as a research supervisor unless otherwise recommended by the Research Advisory Committee.

7. Research Advisory Committee (RAC)

A Research Advisory Committee (RAC) will be constituted for each research scholar, between the second to fourth week from the date of joining.

7.1 Composition of RAC:

1. Head of the Department in which the Research Scholar is enrolled	**- Chairman**
2. Research Supervisor (s)	**- Convener**
3. Two eligible faculty members to be nominated by the Vice-Chancellor from the list suggested by the Supervisor. The list may comprise of faculty members from any department within the university based on research area of the research scholar	**- Member**

In case any member goes on long leave or resigns or retires from the University, the Vice-Chancellor will nominate another member.

7.2 Committee Responsibilities:

7.2.1 To review the research proposal and finalize the topic of research and identify the courses that he / she may have to do.

7.2.2 To periodically review and assist in the progress of the research work of the research scholar.

7.2.3 A research scholar shall appear before the RAC once in six months to make a presentation of the progress of his/her work for evaluation and further guidance. The six-monthly progress reports shall be submitted by the RAC to the University with a copy to the research scholar.

7.2.4 In case the progress of the research scholar is unsatisfactory, the RAC shall record the reasons for the same and suggest corrective measures. If the research scholar fails to implement these corrective measures, the RAC may recommend the cancellation of Ph.D. admission.

8. Course Work

8.1 All the research scholars (Full-time and Part-time) shall undergo four courses for a minimum period of two semesters. The course work shall include a course on research methodology and a course in teaching / education / pedagogy / writing related to their chosen Ph.D. subject. The other two courses may involve advanced techniques, latest developments in the field of research, and subjects related to the research problem.

8.2 The coursework for the "Area of Specialization" for a research scholar shall be prescribed by the Research Supervisor & RAC Members.

8.3 The research scholar has to obtain a minimum of 50% of marks or its equivalent grade in the coursework to be eligible to continue in the program and submit the thesis.

8.4 The research scholars shall be required to complete the coursework within three consecutive attempts, to pursue further their research work. For those who fail to complete the course work within the stipulated time, the Vice-Chancellor may recommend an extension of one more attempt, if the Vice-Chancellor is convinced of his / her performance. If not, the candidate should forfeit the Ph.D. admission.

8.5 Refer coursework guidelines in Annexure I.

9. Progress Reports

9.1 The Research Scholars, both full-time and part-time, shall submit Progress Reports duly endorsed by the RAC once in six months to the Controller of Examinations until they submit their synopsis.

9.2 Failure to submit the progress reports shall entail cancellation of registration.

9.3 The minutes of the meeting of the RAC along with enclosures will be sent to the Controller of Examinations.

10. Break–in–Studies

10.1 Any Research Scholar can be permitted to break his / her studies on medical grounds with the Vice–Chancellor's approval in writing. The break is for a maximum period of one year.

10.2 If prior permission is not sought and obtained, it will be considered as a case of discontinuation and action will be taken to cancel the registration of such candidates.

10.3 For permitting a break in studies on medical grounds, a certificate from the Chief Medical Officer (CMO) is essential. For the resumption of studies, such a candidate should produce a fitness certificate from the CMO.

10.4 Research Scholars who are permitted for break in studies should pay the applicable tuition and other fees to maintain their studentship.

11. Publication of Research Papers

11.1 Research scholars have to publish at least three research papers relevant to their area of research in a peer-reviewed / refereed quality Journal before submission of the thesis.

11.2 The RAC shall certify the quality and authenticity of the publications and ensure that both the candidate and the Research Supervisor are listed as authors of the papers with the correct affiliation.

12. Pre-submission Presentation

12.1 The pre-submission presentation of the thesis is a requirement to enrich the scholar and to fine-tune his / her research presentation.

12.2 This presentation shall be conducted before the submission of the synopsis before the RAC, Faculty members, Research Scholars, and P.G. Students. The recommendations of RAC may be incorporated before the submission of thesis.

12.3 The Research Supervisor shall forward a report on this event with an endorsement of HOD to the Controller of Examinations.

13. Submission of Synopsis

13.1 The submission of a synopsis may be permitted 3 months before the completion of the stipulated duration.

13.2 The Research Scholar shall submit 3 copies of the synopsis approved by the RAC along with a soft copy to the Controller of Examinations through the Research Supervisor, the HOD, and Dean R&D.

14. Submission of Thesis

14.1 The candidate shall submit five copies of the thesis along with the prescribed fee within three months after the submission of the synopsis. A grace period of 30 days may be allowed to submit the thesis after the prescribed duration. If the thesis is not submitted even after the grace period, the candidate has to pay the tuition fee for the year.

14.2 No dues certificates from the Department, Research Centre, Central Libraries, Hostel, etc., must be submitted along with the thesis copies. The Research Supervisor shall forward the thesis copies with the enclosures to the Controller of Examinations through the HOD and the Dean R&D. A soft copy of the thesis in PDF format inline with Shodhganga, shall also be submitted.

14.3 The similarity of the thesis report verified by licensed plagiarism software should not exceed 15%.

15. Procedure for Selection of Panel of Examiners

15.1 A panel of examiners shall be provided by the Research Supervisor to evaluate the thesis from the following subsections (a), (b), (c), and (d).

a) Five examiners from reputed Foreign Universities.
b) Five examiners from IITs / NITs / IIITs / Central Universities, reputed public /private / deemed-to-be universities in India.
c) Examiner(s) should be academicians with a good record of scholarly publications in the field and not below the designation of Associate Professor.
d) If the Research Scholar has carried out part of his / her work in another institution / organization, then the panel of examiners should not be from that institution / organization.

15.2 The Vice-Chancellor will select one Foreign Examiner and one Indian examiner from the panel recommended by RAC. He will also indicate the order of priority of Examiners from 1 to 3 out of 5 for the foreign and Indian examiners.

15.3 Once the Vice-Chancellor has approved the Panel of Examiners, the Controller of Examinations shall forward/ dispatch the Synopsis to the examiners and seek their acceptance for evaluation of the thesis.

15.4 Once the examiner agrees to evaluate the thesis, the Controller of Examinations shall arrange to send the thesis for evaluation along with all the necessary documents and guidelines of assessment.

15.5 If any Examiner denies the invitation to evaluate the thesis, the synopsis shall be sent to another Examiner in the list approved by Vice-Chancellor.

15.6 In the case of rejection of the invitation, the process will be continued till the acceptance of the third foreign examiner and third Indian examiner.

15.7 If the acceptance from the first panel is not received within 45 days, the CoE shall request the Research Supervisor to submit an additional panel members list.

16. Adjudication of Thesis / Evaluation of Ph.D. Thesis

There shall be two external examiners out of whom one shall be from outside the country and one Indian examiner shall be out of the state of the University Hereafter they are called the Board of Examiners.

16.1 The appointed board of examiners shall evaluate the thesis and submit a report on the originality and merit of the thesis for the award of the Ph.D. degree. Each examiner is expected to give a detailed report on the thesis as per the guidelines of the assessment and send it to the controller of examinations.

16.2 The Research Supervisor (Convener) shall consolidate the salient points of the individual examiners reports and submit them to the Controller of Examinations.

16.3 Each examiner shall be requested to send his/her report to the CoE within two months from the date of receipt of the thesis.

16.4 If an examiner(s) fails to send the reports within the stipulated time, the CoE shall send a reminder to him / her after the deadline (two months) and request him / her to send the report within fifteen days. If the concerned Examiner still fails to comply even within the extended period, the CoE shall cancel the appointment forthwith and invite the next Examiner as per the order of preference from the approved panel, to evaluate the thesis.

16.5 Decisions may be taken based on the two reports according to the following:

Sl. No.	Recommendation of Examiners		Decision
	1	2	
1.	Accept	Accept	The scholar will be asked to appear for a public viva-voce examination
2.	Reject	Reject	The thesis will be rejected
3.	Accept	Reject	The thesis will be sent to 3rd Examiner of the same category who rejected
4.	Reject	Accept	The thesis will be sent to 3rd Examiner of the same category who rejected
5.	Accept	Revise	Revise & send to same Examiner who

			recommended revision (if requested by the Examiner)
6.	Revise	Accept	Revise & send to same Examiner who recommended revision (if requested by the Examiner)
7.	Revise	Revise	Revise & send to both Examiners (if requested by the Examiners)

17. Public Viva-voce / Thesis Defence

17.1 The viva-voce Board shall consist of the Research Supervisor, one of the examiners (External), and the Head of the Department (Internal). The Research Supervisor shall be the Convener of the viva-voce Board. The reports of the examiners shall be made available to the Convener (Research Supervisor) of the viva-voce board and the Co-Supervisor (if any). The Research Supervisor must consolidate the results of the viva-voce Examination.

17.2 If an examiner so appointed is unable / unavailable to conduct the viva-voce examination in person, the viva-voce examination may be conducted in online mode with due approval from RAC. Still if he / she is not able to conduct even in online mode, one of the Examiners from the Panel of Indian Examiners submitted shall be appointed to conduct the examination either through offline / online mode with the due approval from the Vice-Chancellor.

17.3 If the Head of the Department happens to be the Research Supervisor, one of the senior Faculty in the department shall be appointed from the Department by the Vice-Chancellor as an Internal Examiner.

17.4 The conduct of Ph.D. viva-voce examination shall be notified fifteen days before the date of the viva-voce examination.

17.5 The viva-voce examination shall be held preferably on working days.

17.6 The viva-voce examination shall be conducted before the RAC, Faculty members, Research Scholars, and P.G. Students.

17.7 The viva-voce Board shall decide the award of the degree.

18. Award of Ph.D. Degree

Based on the recommendation of the Viva-voce board, the University would award the Ph.D. degree to the candidate after due approvals by the Executive Council and Academic Council.

19. Power to Modify

The Academic Council has the right to modify any of the above Regulations from time to time.

SCHEME OF INSTRUCTION

SIDDHARTHA ACADEMY OF HIGHER EDUCATION

V R SIDDHARTHA SCHOOL OF ENGINEERING

SCHEME OF INSTRUCTION FOR Ph.D. PROGRAMME

DEPARTMENT OF CIVIL ENGINEERING

Part A (Minimum 12 Credits)

S. No.	Course Name	Semester	Credits	Hours
1	Research Methodology (Common for all)	I	4	60
2	Course 1: Suggested by Research Supervisor related to research work to be carried out from a pool of courses prescribed by respective department.	I	3	45
3	Oral Presentation/Seminar: Technical Paper Writing relevant to research work/domain	II	2	-
4	Course 2: Suggested by Research Supervisor related to research work to be carried out from a pool of courses prescribed by respective department.	II	3	45
	Total		12	150

S. No.	Course Code	Course Name	L	T	P	C	SE	Total
1	24UC701	Research Methodology (Common to All)	4	0	0	4	100	100
2	24UC702	Oral Presentation/Seminar	0	0	0	2	100	100
3	24UC800	Ph.D. Thesis	-	-	-	-	-	-

SIDDHARTHA ACADEMY OF HIGHER EDUCATION

V R SIDDHARTHA SCHOOL OF ENGINEERING

SCHEME OF INSTRUCTION FOR Ph.D. PROGRAMME

DEPARTMENT OF CIVIL ENGINEERING

POOL I COURSES

S.No	Course Code	Title of the Course	L	T	P	C	SE
1	24CE710A	Soil Stabilization Methods	3	0	0	3	100
2	24CE710B	Applied Geomorphology	3	0	0	3	100
3	24CE710C	Pavement Material Characterization	3	0	0	3	100
4	24CE710D	Advanced Construction Techniques	3	0	0	3	100
5	24CE710E	Development and Applications of Special Concretes	3	0	0	3	100
6	24CE710F	Modern Construction Materials (NPTEL – 12 Weeks)	0	0	3	3	100
7	24CE710G	Environmental Remediation of Contaminated Sites (NPTEL – 12 Weeks)	0	0	3	3	100
8	24CE710H	Environmental Impact Assessment (NPTEL – 12 Weeks)	0	0	3	3	100

POOL II COURSES

S.No	Course Code	Title of the Course	L	T	P	C	SE
1	24CE720A	Building with Stabilized Mud	3	0	0	3	100
2	24CE720B	Geospatial Technologies	3	0	0	3	100
3	24CE720C	Construction Demolition and Waste Management	3	0	0	3	100
4	24CE720D	Sustainable Materials and Green Building	3	0	0	3	100
5	24CE720E	Characterization of Construction Materials	3	0	0	3	100
6	24CE720F	Urban Transportation Systems Planning (NPTEL – 12 Weeks)	0	0	3	3	100
7	24CE720G	Environmental Geomechanics (NPTEL – 12 Weeks)	0	0	3	3	100
8	24CE720H	Applied Environmental Microbiology (NPTEL – 12 Weeks)	0	0	3	3	100

Legend:
L – Lecture, T – Tutorial, P – Practical, C – Credits, SE – Semester End Exam

POOL I COURSES SYLLABUS

24CE710A	SOIL STABILISATION METHODS

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisite	Ground Improvement Techniques	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Impart fundamental knowledge of soil stabilisation
	CO2	Recognise the construction method of lime and cement stabilisation.
	CO3	Identify the industrial wastes/by products for soil stabilisation
	CO4	Analyse the suitability of different grouting techniques and grout materials used for construction
Course Content	**Unit-I: Introduction of Soil Stabilisation** Definition of soil stabilisation, Purpose of soil stabilisation, Requirements of soil stabilisation, Methods of soil stabilisation, Mechanical/granular stabilisation-Principle and Applications, Factors affecting mechanical stabilisation **Unit-II: Lime Stabilisation** Definition of lime stabilisation, Types of limes, lime-soil reactions, Benefits of lime stabilisation, Design of soil-lime mix, Construction process involved in lime stabilized pavement courses **Unit-III: Cement Stabilisation-1** Definition of cement stabilisation, Types of soil-cements, lime-soil reactions, Factors affecting cement stabilisation, Design of soil-cement mix **Unit-IV: Cement Stabilisation-2** Construction process involved in cement stabilized pavement courses, Use of industrial wastes/ by products for soil stabilisation **Unit-V: Grouting** Grouting in soil, Applications of grouting, Types of grouts, Desirable characteristics of grouts, Methods of grouting, Post grout test	
Text Books	[1]. M.R. Hausmann, Engineering Principles of Ground Modification, McGraw-Hill Pub	

	[2]. P. Purushothama Raj, Ground Improvement Techniques, Laxmi publications [3]. S.K. Gulhati and M. Datta, Geotechnical Engineering, Tata McGraw Hill. [4]. J. Maity and B.C. Chattopadhyay, Ground Improvement Techniques, PHI Learning Pvt. Ltd.
Reference Books	[1]. L.R. Kadiyali and N.B. Lal, Principles and Practice of Highway Engineering, Khanna Publications [2]. S.K. Khanna and C.E.G. Justo, Highway Engineering, Nem Chand and Brothers. [3]. HRB SR.No.1, 2000, State-of-the-Art-Report: Lime-Soil Stabilisation, Indian Road Congress
E-resources and other digital material	https://onlinecourses.nptel.ac.in/noc21_ce65/preview

24CE710B	APPLIED GEOMORPHOLOGY

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisite	Remote sensing and GIS / Environmental Sciences	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understanding the fundamental concepts of Geomorphology and their significance, Weathering, soil processes, mass wasting, Endogenic and Exogenic Processes, Landforms associated with igneous activities
	CO2	Understanding the fluvial landforms and drainage patterns; Evolution of landforms in Aeolian, marine, glacial, and karst landscapes. Morphogenesis and morphography; Morphometric parameters analysis, tectonics.
	CO3	Understanding the structural geomorphology, Global geomorphology, Geomorphology of India - Peninsular, extra-peninsular, and Indo-Gangetic Plains. Application of Geomorphology in Mineral Prospecting, Civil Engineering, Hydrogeology and Environmental Studies.
	CO4	Understanding anthropogenic geomorphology, quaternary geomorphology, Applications of Geomorphology in groundwater exploration and storage, flood control, waste disposal, smart city development, oil and natural gas exploration, and infrastructure development.
Course Content	**UNIT I: Fundamentals of Geomorphology and Geomorphic Processes** Fundamental Concepts of Geomorphology; Geomorphic Agents and Processes; Weathering; Soil Processes; Mass Wasting. **UNIT II: Landform Development and Geomorphic Cycles** Igneous Landforms; Fluvial Geomorphic Cycle; Drainage Systems; Aeolian, Coastal, Glacial and Karst Landforms. **UNIT III: Applied, Structural and Regional Geomorphology** Tools of Geomorphology; Applied Geomorphology; Structural	

	Geomorphology; Global Geomorphology and Tectonics; Geomorphology of India. **UNIT IV: Drainage Basin Morphometry and Hydrological Analysis** Drainage Systems and Patterns; River Capture; Drainage Basin Morphometry; Hydrological Cycle; Linear, Areal and Relief Aspects; Hypsometric Analysis. **UNIT V: Climate Change and Environmental Geomorphology** Climate Change and Quaternary Geomorphology; Indicators and Causes of Climatic Change; Anthropogenic Geomorphology; Periglacial Geomorphology and Landforms.
Text Books	[1]. Thornbury, W.D. 2004: Principles of Geomorphology. Wiley Easton Ltd., New York, 10th Edition, 631p. [2]. Richard John Huggett 2011 Fundamentals of Geomorphology Third Edition, Routledge Taylor & Francis Group, 533p [3]. Michael A. Summerfield 2013: Global Geomorphology - An interdiction to study of Landforms, Routledge Taylor & Francis Group, 560p
Reference Books	[1]. Condie, Kent. C. 1982. Plate Tectonics and Crustal Evolution Pergamon Press Inc [2]. Drury, S.A. (2001): Image Interpretation in Geology, Allen and Unwin. [3]. Holmes, A. 1992: Holmes Principles of Physical Geology Edited by P. McL. D. Duff. Chapman and Hall, London.
E-resources and other digital material	1. Geomorphology - Course (nptel.ac.in) Link: https://onlinecourses.nptel.ac.in/noc21_ce29/preview 2. e-book on applied geomorphology, Link: https://www.scribd.com/document/416267411/Applied-Geomorphology 3. e-book on Fundamentals of Geomorphology Link:https://sudartomas.wordpress.com/wp-content/uploads/2012/11/fundamentalsofgeomorphology_routledgefundamentalsofphysicalgeography.pdf

24CE710C	PAVEMENT MATERIAL CHARACTERIZATION

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisite	NIL	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the properties subgrade layers
	CO2	Understand the Stabilization Techniques
	CO3	Understand the Aggregate characterization
	CO4	Understand the desirable properties of the bitumen and bituminous mixes.
	CO5	Understand the properties of cement and Pavement Quality Concrete.
Course Content	**UNIT I: Subgrade Soil Characterization and Ground Improvement** Subgrade Soil Properties; Soil Investigation and Field Testing; Dynamic Soil Properties; Field Compaction; Ground Improvement Techniques; Geotextiles and Geosynthetics. **UNIT II: Soil Stabilization and Grouting Techniques** Principles of Soil Stabilization; Physical and Chemical Stabilization; Stabilizing Admixtures; Grouting Materials and Techniques; Ground Improvement; Geotextiles and Geosynthetics Applications. **UNIT III: Aggregate Characterization and Gradation** Aggregate Properties and Classification; Sampling and Testing; Shape and Surface Characteristics; Aggregate Blending and Gradation; Superpave Aggregate Design; Alternative Aggregate Materials. **UNIT IV: Bituminous Materials and Asphalt Mix Design** Bituminous Binders and Their Properties; Bitumen Emulsions and Modified Binders; Bituminous Mix Design; Superpave Mix Design; Performance Evaluation of Asphalt Mixes; Special Asphalt Mixes and Sustainable Materials.	

	UNIT V: Cementitious Materials and Concrete Pavement Technology Cement and Cement Concrete Characterization; Mineral Admixtures; Advanced Concrete Technologies; Pavement Quality Control; Roller Compacted Concrete; White Topping; Nanotechnology in Concrete Pavements.
Text Books	[1]. Atkins, N. Harold, Highway Materials, Soils and Concretes, Fourth Edition, 2002, Prentice-Hall. [2]. Kerbs Robert D. and Richard D. Walker, Highway Materials, McGraw-Hill, 1971. [3]. Bituminous Road Construction in India, by Prithvi Signh Kandhal PHI, 2016 [4]. Relevant IRC and IS Codes of Practices
Reference Books	[1]principles and Practices of Highway Engineering, L.R.Kadyali,Khanna Publishers 2015 [2]. Advances in Asphalt materials – Road and Pavement construction by Shin Che Huang and Herve Di Benedetto, Woodhouse Publishing, 2015 [3]. Highway Material Testing Laboratory Manual by Khanna S. K., Justo, C.E.G and Veeraragavan, A., Nem Chand & Bros. [4]. Properties of Concrete by A.M. Neville, 5th Edition, Pearson Publications, 2012
E-resources and other digital material	https://nptel.ac.in/courses/105107219

24CE710D	ADVANCED CONSTRUCTION TECHNICS

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisite	Concrete Technology	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand and analyze the concepts of substructure and superstructure construction, including groundwater control, tunneling, and formwork techniques.
	CO2	Demonstrate knowledge of demolition and temporary works, including shoring and portal frame theories in concrete, steel, and timber.
	CO3	Explore and apply modern cladding techniques for framed structures and understand stair designs in various materials.
	CO4	Examine and implement principles of prestressed concrete and repair/rehabilitation methods for structural components.
	CO5	Design and evaluate buildings for industrial and storage use, considering roofs, walls, wind pressure, and rain-related challenges.
Course Content	**Unit-I: Substructure and Superstructure Construction** Substructure: Groundwater control, deep trench excavations, cofferdams and caissons, tunneling and culverts, underpinning, pile foundations, subsoil analysis, and deep basements - Superstructure: Masonry, arches, DPC (Damp Proof Course), waterproofing, concreting, formwork, scaffolding, floors, roofs, roof drainage, and common construction equipment. **Unit-II: Demolition and Temporary Works** Demolition techniques and temporary works, including shoring - Portal frame construction and theory: Concrete, steel, and timber portal frames. **Unit-III: Cladding and Stair Construction** Cladding for framed structures: Cladding panels, infill panels, joints, mastics, sealants and gaskets - Advanced cladding types: Curtain walling, rainscreen cladding, structural glass cladding - Stair design: Concrete stairs and metal stairs.	

	Unit-IV: Prestressed Concrete and Rehabilitation Prestressed concrete: Principles, applications, and systems - Repair and rehabilitation methods: Strengthening beams, columns, slabs, masonry walls, jacketing, and grouting. **Unit-V: Industrial and Storage Buildings** Factory buildings: Roofs and walls - Wind pressure, driving rain, and roof structures in industrial design.
Text Books	[1]. Roy Chudley and Roger Greeno, *Advanced Construction Technology*, 2006, Pearson Education Limited. [2]. Director General Works, CPWD GOI, *Handbook on Repair and Rehabilitation of RCC Buildings*, 2002, New Delhi. [3]. P.C. Varghese, *Building Construction*, 2008, PHI Learning Private Limited.
Reference Books	[1] Jerry Irvine, *Advanced Construction Techniques*, CA Rocketr, 1984. [2] Patrick Powers. J., *Construction Dewatering: New Methods and Applications*, John Wiley & Sons, 1992. [3] Peter H. Emmons, *Concrete Repair and Maintenance Illustrated*, Galgotia Publications Pvt. Ltd., 2001. [4] Robert Wade Brown, *Practical Foundation Engineering Handbook*, McGraw Hill Publications, 1995.
E-resources and other digital material	https://nptel.ac.in/courses/105107219

24CE710E	DEVELOPMENT AND APPLICATIONS OF SPECIAL CONCRETES

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisite	Building materials & Concrete Technology	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand and apply the properties, mix proportioning, and admixture techniques necessary for creating durable and functional normal concrete.
	CO2	Gain knowledge of various special concretes and the methods of curing and handling required to manage their unique properties under different environmental conditions.
	CO3	Develop proficiency in the design, testing, and application of self-compacting concrete, focusing on its unique rheological properties and mix proportioning.
	CO4	Comprehend the advantages of fiber-reinforced concrete, including fiber selection, mix handling, and the impact on concrete's structural properties in its hardened state.
Course Content	**UNIT- I: Normal Concrete** Basic Properties Fresh concrete & Hardened Concrete, Proportioning of normal concrete mixes , mix proportions analysis and adjustments , pores and porosity in concrete , admixtures in concrete **UNIT-II: Special Concrete** Basic understanding of high strength concrete, mass concrete and shotcrete Curing of concrete, cold weather concreting, Hot weather Concreting, importance of right method and Specifications, heat of hydration, thermal stresses, Anti washout underwater concrete, roller compacting concrete, **UNIT-III: Self Compacting Concrete** self-compacting nature of concrete and the proportioning and testing of self-compacting concrete, characteristics and testing of fresh self-compacting concrete, proportioning of self-compacting concrete mix, Rheolgy **UNIT-IV: Fiber Reinforced Concrete** Introduction to fibre-reinforced concrete, need, properties of fibers, proportioning and handling of fibre reinforced concrete, properties of fibre	

	reinforced concrete in its hardened state **UNIT-V: Batching and Mixing of Concrete** Different methods of batching and mixing, introduction to shotcrete along with its characteristics. Shotcreting operations, high strength concrete, use of polymers in concrete, cover concrete, its importance, and considerations for improvement of quality, compaction of concrete with different methods, precast concrete and steam curing of concrete
Text Books	[1] Mehta, P.K., and Monteiro P.J.M., Concrete – Microstructure, Properties and Materials, 3 rd Edition, McGraw Hill Education (India) Private Limited, New Delhi, Prentice-Hall, Inc., 2006. [2] Neville, A.M., Properties of concrete, 5 th Edition, Pitman Publishers, New Delhi, India 1996. [3] Shetty, M.S., Concrete Technology (Theory and Practice), 7 th Edition, S. Chand & Company Ltd., New Delhi, 2013
Reference Books	[1] Sidney, M., Young, J.F., and Darwin, D., Concrete, 2 nd Edition, Prentice-Hall, Pearson Education, Inc., New Jersey, 2003. [2] Kosmatka, S.H., Kerkhoff, B., and Panarese, W.C., Design and Control of Concrete Mixtures, 14 th Edition, Portland Cement Association, Skokie, Illinois, USA, 2003. [3] JSCE subcommittee, Standard specifications for concrete structures – 2007 "Materials and construction", Report: JSCE guidelines for concrete (No. 16), Japan Society of Civil Engineers, Tokyo, Japan, 2010
E-resources and other digital material	https://nptel.ac.in/courses/105104206

24CE710F	MODERN CONSTRUCTION MATERIALS

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory (NPTEL)	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisite	Civil Engineering Materials	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Demonstrate an understanding of modern construction materials by explaining their science, engineering principles, and technological applications.
	CO2	Analyze the atomic bonding, structure of solids, and microstructural development to predict the behavior of construction materials.
	CO3	Evaluate surface properties, stress response, failure theories, and thermal properties to assess the performance of construction materials under different conditions.
	CO4	Select appropriate structural materials, including wood, polymers, metals, concrete, and glass, based on their properties and performance requirements for construction applications.
	CO5	Identify and apply suitable non-structural materials, finishes, and accessories, such as waterproofing, floor finishes, and anchors, to enhance functionality and aesthetics in construction projects.
Course Content	**Unit-I: Basics** Introduction to Modern Construction Materials - Science, Engineering and Technology of Materials **Unit-II: Microstructure** Atomic Bonding- Structure of Solids - Movement of Atoms - Development of Microstructure **Unit-III : Material Behaviour** Surface Properties - Response to Stress - Failure Theories - Fracture Mechanics - Rheology & Thermal properties **Unit-IV : Structural Materials** Review of Const. Materials & Criteria for Selection - Wood and Wood Products - Polymers - Fibre Reinforced Polymers - Metals - Bituminous	

	Materials – Concrete - Glass **Unit-V : Non-structural Materials, Accessories and Finishes** Perception of Non-Structural Materials – Water Proofing – Floor Finishes - Anchors
Text Books	[1] Callister, W.D. and Rethwisch, D.G., *Materials Science and Engineering: An Introduction*, 10th Edition, John Wiley & Sons, 2018. [2] Ashby, M.F. and Jones, D.R.H., *Engineering Materials 1: An Introduction to Properties, Applications and Design*, 5th Edition, Butterworth-Heinemann, 2019.
Reference Books	[1] Chudley, R. and Greeno, R., *Building Construction Handbook*, 13th Edition, Routledge, 2020. [2] Neville, A.M., *Properties of Concrete*, 5th Edition, Pearson Education, 2011. [3] Gambhir, M.L., *Concrete Technology*, 5th Edition, McGraw Hill Education, 2017. [4] Rangwala, S.C., *Engineering Materials*, Charotar Publishing House, Latest Edition. [5] Shetty, M.S., *Concrete Technology: Theory and Practice*, S. Chand Publishing, Latest Edition.
E-resources and other digital material	[1] https://archive.nptel.ac.in/courses/105/106/105106053/#

24CE710G	ENVIRONMENTAL REMEDIATION OF CONTAMINATED SITES

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory (NPTEL)	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisite	Geotechnical Engineering	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the principles of environmental remediation, including regulatory frameworks and waste classification.
	CO2	Evaluate risk assessment methodologies for human health and ecological systems in contaminated sites.
	CO3	Analyze and design remediation strategies for contaminated groundwater using appropriate technologies.
	CO4	Develop solutions for soil and sediment remediation, integrating advanced techniques like solidification and chemical treatments.
	CO5	Apply innovative approaches such as bioremediation, phytoremediation, and thermal processes to real-world remediation challenges.
Course Content	**Unit-I: Introduction to Environmental Remediation** Concept of environmental remediation - Overview of laws, regulations, and remediation - Definitions: hazardous waste, waste classification, and corrective action. **Unit-II: Risk Assessment in Contaminated Sites** Human health risk assessment: data collection, exposure assessment, toxicity assessment, and risk characterization - Ecological risk assessment - Risk-based corrective actions and communication strategies. **Unit-III: Remedial Options for Groundwater** Plume containment: extraction wells, trenches, and barriers - Pump and treat techniques - Permeable reactive barriers: redox reactions, design considerations - Monitored natural attenuation: evaluation, monitoring, and case studies. **Unit-IV: Remedial Options for Soil and Sediments** Soil excavation and landfilling - Solidification/stabilization: leaching mechanisms and design considerations - Chemical treatment processes and soil vapor extraction techniques - Advanced techniques: surfactant extraction and soil washing. **Unit-V: Bioremediation, Phytoremediation, and Thermal Processes** Bioremediation: principles, processes, and applications - Phytoremediation:	

	mechanisms and examples - Thermal processes: incineration, thermal desorption, and soil oxidation.
Text Books	[1]. LaGrega, M.D., Buckingham, P.L., Evans, J.C., *Hazardous Waste Management*, McGraw-Hill, 1994. [2]. Vamos, R.J., *Hazardous and Industrial Waste Treatment*, Prentice Hall, 1995.
Reference Books	[1]. Sharma, H. D., & Reddy, K. R. *Geoenvironmental engineering: site remediation, waste containment, and emerging waste management technologies*. John Wiley & Sons, 2004.
E-resources and other digital material	https://onlinecourses.nptel.ac.in/noc23_ce11/preview

24CE710H	ENVIRONMENTAL IMPACT ASSESSMENT

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory (NPTEL)	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisite	Environmental Engineering	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	understand the environment management and concept of EIA.
	CO2	understand the world sustainable development, EIA law and process.
	CO3	analyse the EIA assessment methods on natural parameters.
	CO4	analyse the EIA assessment methods on socio-economic parameters.
	CO5	interpret the Strategic environmental assessment and case studies.
Course Content	**UNIT I: Fundamentals of Environmental Impact Assessment** Introduction to Environmental Management; Environmental Components; Concepts, Purpose and Process of EIA; Evolution of EIA; EIA in the United States and India. **UNIT II: EIA Framework, Policies and Procedures** Sustainable Development; Environmental Laws and Policies; Institutional Framework; EIA Process; Impact Prediction, Mitigation, Public Participation and Environmental Review. **UNIT III: Environmental Impact Assessment Methods** EIA Assessment Methods for Air, Water, Soil, Geology and Climate; Ecological Assessment; Baseline Studies; Impact Prediction and Evaluation. **UNIT IV: Specialized Environmental Impact Assessment and Management** Ecosystem Services Assessment; Coastal Ecology; Noise and Transport Assessment; Cultural Heritage; Health and Socio-economic Impacts; Risk Assessment; Environmental Management Plans. **UNIT V: Advanced Environmental Assessment and Case Studies**	

	Strategic Environmental Assessment; EIA Reporting and Review; Environmental Case Studies; Infrastructure and Development Project Assessments.
Text Books	[1] Glasson, J., Therivel, R. and Chadwick, A., *Introduction to Environmental Impact Assessment*, 5th Edition, Routledge, 2024. [2] Canter, L.W., *Environmental Impact Assessment*, 2nd Edition, McGraw-Hill International Editions, 1996.
Reference Books	[1] Therivel, R., *Strategic Environmental Assessment in Action*, 2nd Edition, Routledge, 2013. [2] Morris, P. and Therivel, R. (Eds.), *Methods of Environmental Impact Assessment*, 4th Edition, Routledge, 2023.
E-resources and other digital material	[1] https://archive.nptel.ac.in/courses/124/107/124107160/

POOL II COURSES SYLLABUS

24CE720A	BUILDING WITH STABILISED MUD

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisite	Ground Improvement Techniques	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Impart fundamental knowledge of building with stabilised mud
	CO2	Recognise the process of manufacturing stabilised mud block
	CO3	Evolution of strength and durability of stabilized mud blocks
	CO4	Impart fundamental knowledge of rammed earth
Course Content	**Unit-I: Introduction to Building with Stabilised Mud** Concept of Stabilized Mud Blocks (SMB), Purpose of building with stabilised mud, Selection of soils for SMB manufacture, Stabilisers and Waste materials for SMB manufacture **Unit-II: The process of stabilised mud block manufacture** Soil preparation, Mixing of soil and stabiliser, Addition of moisture to mixture, Block pressing in Mardini, Stacking and curing the blocks, Labour utilization in block production, Troubleshooting in block making **Unit-III: Evolution of Stabilized Mud Blocks-Strength Criteria** Strength of Blocks, The wet compressive strength test **Unit-IV: Evolution of Stabilized Mud Blocks-Durability Criteria** Durability test-The alternate wetting and drying test, Expansion on saturation test **Unit-V: Rammed Earth** Rammed Earth as an alternative for wall construction, Equipment for Rammed Earth, The process of ramming	
Text Books	[1]. Building with stabilized earth by KS Jagadeesh, I. K. International Pvt Ltd. [2]. Jagadish K.S., Venkatarama Reddy B.V. and Nanjunda Rao K.S. (2017). Alternative Building Materials and Technologies, New-Age International	

	Publishers [3]. Laurie baker, Mud, Center of Science and Technology for Rural Development (COSTFORD) [4]. Laurie baker, Houses How to reduce Building costs, CAPART
Reference Books	[1]. B.V. Venkatarama Reddy, Compressed earth block & rammed earth structures, Springer. [2]. B.V. Venkatarama Reddy, Sustainable building technologies, Special section: Application of S & T to rural areas, current science, Vol. 87, No. 7, 2004, pp. 899-907 [3]. B.V. Venkatarama Reddy, A manual for laboratory tests on masonry materials and masonry elements, Bharat Ratna Sir M Visvesvaraya National Training Facility for Skills for All, Government of Karnataka, India
E-resources and other digital material	-

24CE720B	GEOSPATIAL SCIENCE

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisite	Surveying & Geomatics	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the concepts of Geographical Information Systems (GIS) and their applications in various engineering fields.
	CO2	Evaluate and utilize appropriate remote sensing data products for mapping, monitoring, and management applications.
	CO3	Apply various image processing techniques for diverse geospatial applications.
	CO4	Use Remote Sensing (RS) and GIS techniques to solve complex engineering problems.
	CO5	Demonstrate applications of geospatial science in areas such as disaster management, urban planning, and water resources.
Course Content	**Unit I: Fundamentals of GIS** Components of GIS: Hardware, Software, Data, People, and Processes - Types of Data: Spatial and Attribute - Coordinate Systems: Geographic and Projected Coordinate Systems - Maps and Scales: Types and Applications - Raster and Vector Data Models: Digitization, Data Editing, and Thematic Map Generation - Spatial Database Management Systems: Entity-Relationship Models, Data Storage, and Representation **Unit II: Basics of Remote Sensing** Introduction to Remote Sensing: Data Collection and Interpretation - Electromagnetic Spectrum: Energy Interactions with Atmosphere and Earth Surface Features - Types of Resolution: Spatial, Spectral, Radiometric, and Temporal - Indian Satellites and Sensors: IRS, CARTOSAT, Landsat, and Sentinel - Data Formats: Optical, Thermal, Microwave, and LiDAR Processing **Unit III: Image Processing Techniques** Image Pre-Processing: Noise Removal, Image Registration, and Resampling - Classification Techniques: Supervised and Unsupervised Classification - Advanced Techniques: Artificial Neural Networks (ANN) and Support Vector	

	Machines (SVM) - Vegetation and Water Indices: NDVI, EVI, and NDWI - Digital Elevation Models (DEM) and Digital Terrain Models (DTM) **Unit IV: Geospatial Applications in Engineering** Land Use/Land Cover Analysis - Applications in Agriculture, Forestry, Geology, and Water Resources - Urban Planning and Infrastructure Development - Disaster Management: Floods, Earthquakes, and Landslides - Monitoring Environmental Changes **Unit V: Integration and Case Studies** Classification - Advanced Techniques: Artificial Neural Networks (ANN) and Support Vector Machines (SVM) - Vegetation and Water Indices.
Text Books	[1] Manugula, S. S., and Veeranna Bommakanti. *Photogrammetry, GIS & remote sensing.* Educreation Publishing, 2017. [2] *Textbook of Remote Sensing and Geographical Information Systems*, M. Anji Reddy, BS Publications, 4th Edition, 2012.
Reference Books	[1] Remote Sensing and Image Interpretation, Lillesand, T.M, R.W. Kiefer and J.W. Chipman, Wiley India Pvt. Ltd., New Delhi,7th Edition 2015 [2] Remote Sensing and GIS, BasudeBhatta, Oxford UniversityPress,2nd Edition, 2011
E-resources and other digital material	NPTEL courses- 105- 101,103,107 modules

24CE720C	CONSTRUCTION DEMOLITION AND WASTE MANAGEMENT

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisite	NIL	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand principles of sustainability and apply life-cycle analysis to evaluate construction materials and techniques.
	CO2	Analyze intrinsic properties of materials affecting sustainability and durability in construction.
	CO3	Evaluate sustainable alternatives for aggregates, cement, and concrete, incorporating innovative materials and recycling strategies.
	CO4	Assess durability and sustainability of advanced materials like FRPs, steel, and masonry, emphasizing life-cycle performance.
	CO5	Design green and energy-efficient buildings through advancements in nanotechnology and sustainable building practices.
Course Content	**Unit-I: Recycling Waste** Fundamentals, Types of wastes, Types of recycling and reuse, The Jobsite Recycling Center, Transportation of Recycled Materials, Hazardous Materials, Automated Equipment. Waste Assessment, Waste Assessment Rules of Thumb, Waste Types, Residential Construction Waste Management. **Unit-II: Recycling and Reuse of Demolition Waste** The Site Audit, The Market Audit, Demolition Recyclables, Hazardous Waste. ABC: Asphalt, Brick and Concrete Recycling, Structural Steel, Wood Framing and Heavy Timber, Glass, Plastics and Composites, Rubber, Gypsum Wallboard. **Unit-III: Recycling Waste Management Plan** Create the Plan, Define the Goals, Define the Waste Producers, Plan the Work, Educate Subcontractors and Suppliers, Recycling Zone Management. Waste Management Credits under LEED, Innovation and Design Process Credits, Waste Management Policy Compliance.	
	Unit-IV: Recycling	

	Reasons to Recycle, The Waste Management Streams, The Economic Case, About LEED and Other Certification, The Choice of Method, The Recycling Method, Buy Recycled Products, Repair and Rehabilitation Methods, Documenting Compliance.Contractor-Generated Information, Outside Information Management, Special Items Documentation. **Unit-V: Resources** Contaminants in C&D Waste Equipment, Salvage Materials Checklist, Density Conversion Factors. Recycling Marketing and Public Relations, Marketing to the Public, Marketing to Recyclers, Recycling of Unusual Materials.
Text Books	[1] Kibert, C.J., *Sustainable Construction: Green Building Design and Delivery*, 5th Edition, John Wiley & Sons, 2022. [2] Yost, P. and Halstead, G., *A Contractor's Guide to Construction and Demolition Recycling*, 2nd Edition, Butterworth-Heinemann, 2015.
Reference Books	[1] Pichtel, J., *Waste Management Practices: Municipal, Hazardous, and Industrial*, 3rd Edition, CRC Press, 2023. [2] Tam, V.W.Y. and Lu, W. (Eds.), *Construction Waste Management*, CRC Press, 2019. [3] Peng, C.L., Scorpio, D.E. and Kibert, C.J., *Strategies for Successful Construction and Demolition Waste Recycling Operations*, *Construction Management and Economics*, Vol. 15, No. 1, 1997. [4] Charles J. Kibert (Ed.), *Construction Waste Management Handbook*, Green Building Council Publications, Latest Edition.
E-resources and other digital material	[1] https://nptel.ac.in/courses/105107219

24CE720D	SUSTAINABLE MATERIALS AND GREEN BUILDING

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisite	NIL	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand principles of sustainability and apply life-cycle analysis to evaluate construction materials and techniques.
	CO2	Analyze intrinsic properties of materials affecting sustainability and durability in construction.
	CO3	Evaluate sustainable alternatives for aggregates, cement, and concrete, incorporating innovative materials and recycling strategies.
	CO4	Assess durability and sustainability of advanced materials like FRPs, steel, and masonry, emphasizing life-cycle performance.
	CO5	Design green and energy-efficient buildings through advancements in nanotechnology and sustainable building practices.
Course Content	**Unit-I: Principles of Sustainability and Life-Cycle Analysis** Introduction to sustainability in construction - Sustainable construction principles and material selection - Life-cycle analysis (LCA): Origins, processes, and challenges in construction - Key intrinsic properties influencing sustainability: Diffusion coefficient, porosity, permeability, and heat-mass interaction - Durability of bio-based materials. **Unit-II: Sustainable Aggregates and Cement Materials** Aggregates: Types, production substitutes, and recycling strategies - Innovations in alternative aggregates and sustainable management practices - Environmental, economic, and societal responsibilities in aggregate sourcing - Cement and concrete: Environmental impacts, CO_2 emissions, and resource depletion - Role of cement replacement materials and strategies for sustainable concrete structures. **Unit-III: Durability of Sustainable Construction Materials** Durability in sustainable materials: Environmental exposure and material	

	properties - Methods for assessing and improving durability in recycled aggregates and bio-based materials - Impact of durability on life-cycle assessments - Fibre-Reinforced Polymers (FRPs): Durability, sustainability concepts, embodied energy, and life-cycle cost analysis. **Unit-IV: Sustainable Steel, Masonry, and Nanotechnology** Metals in construction: Sustainability aspects, types, and corrosion protection - Masonry materials: Properties, sustainability, and design life of buildings - Nanotechnology applications in construction: Recent advances, special properties, and sustainable solutions. **Unit-V: Green Buildings** Energy-efficient building development: Passive and low-energy designs - Sustainability through improved energy efficiency and embodied energy in construction - Advances in HVAC systems and simulation studies for sustainable building practices - Challenges and opportunities in achieving energy-efficient buildings.
Text Books	[1]. *Sustainability of Construction Materials* by Jamal M. Khatib, CRC Press, 2009. [2]. *Sustainability through Energy-Efficient Buildings* by Amritanshu Shukla and Atul Sharma, CRC Press, 2018.
Reference Books	[1] *Construction Materials, Methods & Techniques* by William P. Spence, Yesdee Publication, 2012. [2] *Concrete Structure Properties & Materials* by P.K. Mehta and P.J.M. Mantreio, Prentice Hall.
E-resources and other digital material	[1] https://nptel.ac.in/courses/105107219

24CE720E	CHARACTERIZATION OF CONSTRUCTION MATERIALS

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisite	Building materials	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand and classify construction materials based on their physical, mechanical, and chemical properties for specific construction applications.
	CO2	Analyze the mechanical properties of materials, such as strength, elasticity, and hardness, to ensure their suitability for structural requirements.
	CO3	Evaluate the thermal and durability characteristics of construction materials to predict their performance under varying environmental conditions.
	CO4	Apply advanced material characterization techniques, including microscopy, spectroscopy, and non-destructive testing, to investigate material behavior.
	CO5	Integrate sustainable and innovative materials into construction practices by understanding modern trends and addressing real-world challenges.
Course Content	**Unit-I: Introduction** Overview of Construction Materials - Role of Material Characterization - Physical Properties - Standards and Codes **Unit-II: Mechanical Properties of Construction Materials** Strength Analysis - Elastic and Plastic Behavior - Hardness and Toughness - Fatigue and Creep **Unit-III: Thermal and Durability Properties** Thermal Properties - Durability Factors - Aging and Service Life - Case Studies **Unit-IV: Advanced Characterization Techniques** Microscopy methods - Spectroscopy techniques - Non-destructive testing -	

	Thermal analysis **Unit-V: Case Studies and Modern Innovations** Sustainable materials - Advanced materials - Field applications - Emerging trends.
Text Books	[1]. William D. Callister and David G. Rethwisch, *"Materials Science and Engineering: An Introduction* (10th Edition)*",* Wiley Publishing. [2]. P. Kumar Mehta and Paulo J.M. Monteiro, "*Concrete: Microstructure, Properties, and Materials* (4th Edition), McGraw-Hill Education Publishing. [3]. Sam Zhang, Lin Li, and Ashok Kumar, "*Material Characterization Techniques"*, CRC Press Publishing. [4]. Zongjin Li, "*Advanced Concrete Technology",* Wiley Publishing.
Reference Books	[1]. Ferdinand P. Beer, E. Russell Johnston Jr., and John T. DeWolf, "*Mechanics of Materials* (7th Edition)", McGraw-Hill Education Publishing. [2]. R. Chudley and R. Greeno, "*Building Construction Handbook* (11th Edition)", Routledge Publishing. [3]. Neville A.M, " *Properties of Concrete* (5th Edition)", Pearson Publishing
E-resources and other digital material	Characterization of Construction Materials - Course (nptel.ac.in)

24CE720F	URBAN TRANSPORTATION SYSTEMS PLANNING

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory (NPTEL)	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisite	Transportation Engineering	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Analyze various stages in transport Planning Process
	CO2	Apply various methods for data collection by trip Generated
	CO3	Apply Traditional and Synthetic methods of trip distribution
	CO4	Apply and finalize the route choice and network design
	CO5	Understand the urban transportation modeling and forecasting
Course Content		

UNIT I: Fundamentals of Urban Transportation Planning and Travel Demand Forecasting
Urban Transportation Systems; Transportation Planning Process; Hierarchical Planning; Four-Step Travel Demand Forecasting; Data Collection Techniques.

UNIT II: Trip Generation Modelling
Trip Generation Concepts; Trip Classification; Factors Affecting Trip Generation; Regression and Category Analysis; Model Calibration, Validation and Application.

UNIT III: Trip Distribution Modelling
Trip Distribution Principles; Growth Factor Methods; Gravity Model; Opportunity Models; Doubly Constrained Models; Linear Programming Approaches.

UNIT IV: Modal Split Analysis and Traffic Assignment
Mode Choice Modelling; Aggregate and Disaggregate Models; Logit Models; Traffic Assignment Techniques; Network Analysis; Route Choice Behaviour; Dynamic Traffic Assignment.

UNIT V: Land Use, Freight Transportation and Emerging Trends
Land Use and Transportation Interaction; Urban Goods Movement; Freight Planning; Forecasting Techniques; Activity-Based Modelling; Spatial Data

	Infrastructure (SDI); Big Data Analytics.
Text Books	[1] Kadiyali, L.R., *Traffic Engineering and Transport Planning*, 9th Edition, Khanna Publishers, New Delhi, 2017. [2] Papacostas, C.S. and Prevedouros, P.D., *Transportation Engineering and Planning*, 3rd Edition, Pearson Education, 2008.
Reference Books	[1] Ortúzar, J. de D. and Willumsen, L.G., *Modelling Transport*, 5th Edition, John Wiley & Sons, 2021. [2] Hutchinson, B.G., *Principles of Urban Transport Systems Planning*, Hemisphere Publishing Corporation, 1974.
E-resources and other digital material	http://www.nptel.ac.in/105105208

24CE720G	ENVIRONMENTAL GEOMECHANICS

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory (NPTEL)	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisite	Environmental Engineering	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the interdisciplinary connection between geotechnical engineering and environmental challenges.
	CO2	Characterize the physico-chemical and mineralogical properties of soils and their implications on geomechanical behavior.
	CO3	Analyze soil-water-air interactions and assess their influence on geomechanical properties like shrinkage, swelling, and cracking.
	CO4	Evaluate mass transport phenomena and soil's thermal and electrical properties for various environmental applications.
	CO5	Develop sustainable solutions for geoenvironmental issues, considering legal frameworks and societal impacts.
Course Content	**Unit I: Introduction to Environmental Geomechanics** Scope and relevance of Environmental Geomechanics - Nature of soil and its role in geoenvironmental challenges - Overview of natural and manmade environments. **Unit II: Soil Characterization** Physico-chemical properties of soil - Mineralogical properties of soil - Soil-water-air interaction. **Unit III: Soil Behavior and Hydraulic Properties** Shrinkage and swelling characteristics - Cracking mechanisms in soils - Hydraulic conductivity and its environmental implications. **Unit IV: Mass Transport and Soil Properties** Mass transport phenomena in soils - Thermal and electrical properties of soils - Case studies on soil behavior in environmental contexts. **Unit V: Applications in Geoenvironmental Engineering** Containment of pollutants: landfill design and remediation techniques - Sustainable practices in geotechnical engineering - Legal and regulatory considerations in addressing geoenvironmental issues.	

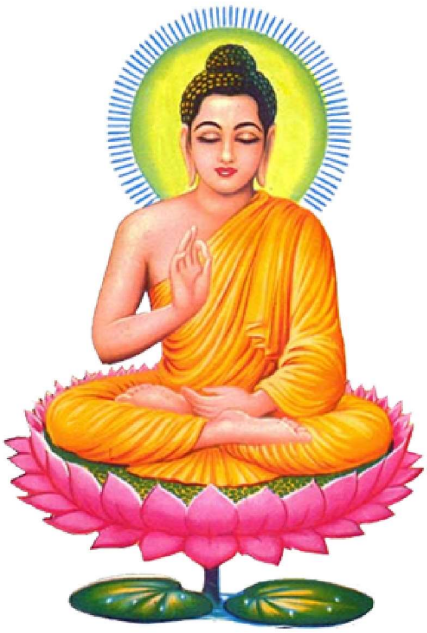
Text Books	[1]. Mitchell, J.K., *Fundamentals of Soil Behavior*, John Wiley & Sons, 2005. [2]. Reddi, L.N., Inyang, H.F., *Geoenvironmental Engineering: Principles and Applications*, CRC Press, 2000.
Reference Books	[1]. Rowe, R.K., *Geotechnical and Geoenvironmental Engineering Handbook*, Springer, 2012.
E-resources and other digital material	https://archive.nptel.ac.in/courses/105/101/105101200/

24CE720H	APPLIED ENVIRONMENTAL MICROBIOLOGY

Course Category:	Ph.D.	**Credits:**	3
Course Type:	Theory (NPTEL)	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisite	Environmental Engineering and Environmental studies	**Continuous Evaluation:**	0
		Semester end Evaluation:	100
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	understand the basic microbiology and microbial energetics cycle.
	CO2	understand the microbial metabolism, growth and ecosystems.
	CO3	study the investigations in environmental microbiology.
	CO4	analyse the wastewater microbiology and bioremediation.
	CO5	understand the epidemiology and role bioinformatics tools.
Course Content	**UNIT I: Fundamentals of Microbiology and Microbial Energetics** Introduction; cell elements and composition cell and its composition, cytoplasmic membrane prokaryotic cell division microbes and their environmental niches historical roots of microbiology, nucleic acids and amino acids DNA structure, replication, and manipulation protein and its structure; regulation microbial nutrition microscopy: light microscopy, 3D Imaging, AFM, Confocal canning laser microscopy; Microbial energetics cycle and diversity Stoichiometry and bioenergetics Oxidation-reduction NAD, energy-rich compounds and energy storage Mathematics of microbial growth Glycolysis Respiration Citric-acid Catabolic Alternatives Phototrophy, Chemolithotrophy, anaerobic respiration (Nitrate and Sulfate reduction; Acetogenesis; Methanogenesis; Metal, Chlorate, and organic electron acceptors). **UNIT II: Microbial Metabolism, Diversity and Ecology** Microbial metabolism and functional diversity of bacteria prokaryotic diversity classical taxonomy life tree of life major catabolic pathways catalysis and enzymes energy conservation sugars and polysaccharides, amino acids, nucleotides, lipids; microbial ecosystems population, guilds, and communities environments and microenvironments microbial growth on surfaces environmental effects on microbial growth; environmental genomics and microbial ecology; genetic exchange environmental genomics microbial ecology horizontal and vertical gene transfer: replication, transformation	

	transduction. **UNIT III: Microbial Genetics, Symbiosis and Environmental Applications** Microbial symbiosis and virus, mutation and its rate, genetic recombination, population dynamics, virus, viroid, prion, application of environmental microbes; investigations in environmental microbiology: sampling, detection, isolation, taxonomic and functional annotation and quantification; introductory bioinformatics and data analysis microbial sampling culture based and culture independent tools molecular biology tools: cloning, amplification, sequencing, case study. **UNIT – IV: Environmental Microbiology and Bioremediation** Bioremediation and wastewater microbiology, bioremediation and examples, acid mine drainage, enhanced metal recovery, wastewater microbiology, drinking water microbiology, drinking water microbiome and treatment, microbial instability, water borne microbial diseases, solid waste microbiology and antimicrobial resistance, landfills, leachate, anaerobic degradation phases, antimicrobial resistance. **UNIT – V: Public Health Microbiology and Bioinformatics** Epidemiology and biosensors, public health, epidemics, biosensors, wearable biosensors, built microbiology, exposomes and bioinformatics, exposure routes, microbes living around us, exposomes basic bioinformatics, bioinformatics tools available online
Text Books	[1] Maier, R.M., Pepper, I.L. and Gerba, C.P., *Environmental Microbiology*, 4th Edition, Academic Press, 2021. [2] Rittmann, B.E. and McCarty, P.L., *Environmental Biotechnology: Principles and Applications*, 2nd Edition, McGraw-Hill Education, 2020.
Reference Books	[1] Madigan, M.T., Bender, K.S., Buckley, D.H., Sattley, W.M. and Stahl, D.A., *Brock Biology of Microorganisms*, 16th Edition, Pearson, 2021. [2] Atlas, R.M. and Bartha, R., *Microbial Ecology: Fundamentals and Applications*, 4th Edition, Benjamin Cummings, 1998.
E-resources and other digital material	[1] https://archive.nptel.ac.in/courses/105/107/105107173/#



Department of Civil Engineering

VELAGAPUDI RAMAKRISHNA SIDDHARTHA SCHOOL OF ENGINEERING

SIDDHARTHA

ACADEMY OF HIGHER EDUCATION

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