Ref.No.:/AU/CE/BOS-03/2026-27/MOM-03 Date: 05/02/2026

DEPARTMENT OF CIVIL ENGINEERING

3rd Board of Studies: Minutes of Meeting

The **3rd Board of Studies Meeting** of the Civil Engineering department was held on **05th May 2026 at 10:00 AM** at Seminar hall, **Civil Block, Annamacharya University: Rajampet**. The following members were present at the meeting:

Members Present:

Sl.No	Name	Affiliation	Role in BoS
1	Dr. N.R. Gowthami	Assistant Professor& Head, Dept of Civil Engineering, Annamacharya University,Rajampet. Ph: 8985515900 Email: nrg@aitsrajampet.ac.in	Chairperson
2	Dr. S. Venkata Vara Prasad	Assistant Professor, Dept of Civil Engineering Annamacharya University, Rajampet. Ph: 8309414515,Email: svvp@aitsrajampet.ac.in	Senior Faculty – Member
3	Mr. B Raghunatha Reddy	Assistant Professor,Dept of Civil Engineering Annamacharya University, Rajampet. Ph: 7893322879, Email: brr@aitsrajampet.ac.in	Course Coordinator-Member
4	Mr. D Rama Bhupal Reddy	Assistant Professor, Dept of Civil Engineering Annamacharya University,Rajampet. Ph: 79893 20209 Email: ramabhupalreddy1@gmail.com	Course Coordinator-Member
5	Dr. Gangolu. Appa Rao	Professor, Dept. of Civil Engg., IIT, Madras, Chennai. Ph: 9444047421. Email: garao@iitn.ac.in	Subject Expert – Member
6	Dr. A. Ramachandra Murthy	Senior Principal Scientist, CSIR- SERC, Chennai. Ph:9445339510 Email: murthyarc@serc.res.in	Subject Expert – Member
7	Dr. M. Srimurali	Professor, Dept. of Civil Engineering, SV U College of Engineering , Tirupati Email :msrimurali@gmail.com	University Nominee-Member
8	Er. K.Sreenivasa Murthy	Executive Engineer , Roads & buildings, Kadapa, Ph:440466250,Email: ksmurthy.Seenu@gmail.com	Industry Representative – Member
9	Mr. G Sarath Chandra	Managing Director,Ravi Builders and Planners. Email :sarathchandra9222@gmail.com	Alumni Representative - Member

Members Absent: NIL

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. G Sarath Chandra	

Agenda of the Meeting:

Item No	Particulars
BoS/2026/CIVIL/3.1	**3.1** Ratification of the Minutes of the 2nd Board of Studies Meeting (UG & PG).
BoS/2026/ CIVIL /3.2	**3.2** To discuss and finalize the course structure for III & IV Year B. Tech programme.
BoS/2026/ CIVIL /3.3	**3.3** To discuss and approve the detailed syllabus for III Year (I & II Semesters).
BoS/2026/ CIVIL /3.4	**3.4** To discuss matters related to Department Advisory Board (DAB) and Programme Assessment Committee (PAC).
BoS/2026/ CIVIL /3.5	**3.5** To review and approve the panel of Subject Experts for III Year (I & II Semesters).
BoS/2026/ CIVIL /3.6	**3.6** Discussion on feedback received regarding the curriculum.
BoS/2026/ CIVIL /3.7	**3.7** Any other item with permission of the Chair.

Welcome Address:

Dr. N. R. Gowthami, Chairperson, welcomed all the members and expressed her gratitude to the external experts, university nominee, industry representative, and alumni member for their presence and valuable support.

The Chairperson introduced all the members. Special mention was made of the external experts:

- Dr. Gangolu Appa Rao, Professor, IIT Madras
- Dr. A. Ramachandra Murthy, Senior Principal Scientist, CSIR-SERC, Chennai
- Dr. M. Srimurali, Professor, SVU College of Engineering, Tirupati
- Er. K. Sreenivasa Murthy, Executive Engineer, R&B, Kadapa
- Mr. N. Sarath Chandra, Managing Director, Ravi Builders and Planners

The agenda was presented and taken up for detailed discussion.

Deliberations and Resolutions:

<u>Agenda Item No. BoS/2026/CIVIL/3.1:</u> Ratification of 2nd Board of Studies Meeting minutes

The minutes were reviewed. The Board ratified the 2nd Board of Studies Meeting minutes. i.e., II B.Tech and II M.Tech Syllabus and Subject experts of II B.Tech.

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. G Sarath Chandra	

Dr. Gangolu Appa Rao emphasized strengthening fundamental subjects with practical exposure. Dr. A. Ramachandra Murthy suggested inclusion of real-time case studies in core subjects through Internship.

Agenda Item No. BoS/2026/CIVIL/3.2: Course structure for III & IV B.Tech of AU24 Regulations:

- Dr. M. Srimurali recommended inclusion of advanced electives.
- Er. K. Sreenivasa Murthy stressed industry-oriented courses like construction management and field practices. Insisted Internships to be incorporated in the curriculum.
- Mr. N. Sarath Chandra suggested adding project-based learning components by Civil Engineering Workshop, to add skill oriented learning in students.Since AI is playing major role across all the sectors, experts recommended to incorporate AI in Curriculum
- Dr. A. Ramachandra Murthy suggested inclusion of emerging areas like sustainable materials and advanced structural analysis.
- Dr. Gangolu Appa Rao recommended strengthening analytical components.
- Dr. M. Srimurali emphasized aligning syllabus with academic standards and outcome-based education.
- Er. K. Sreenivasa Murthy stressed inclusion of field-oriented and practical components.

N. Sarath Chandra suggested incorporating **skill-based and industry-relevant topics**, along with replacing "Lab" with "Laboratory," assigning mentors for each internship batch, replacing "Rehabilitation" with "Retrofitting of Structures," separating Internship (4-1) and Project (4-2), removing "Industry" from titles, and clarifying the summer vacation structure

The Course structure of III & IV B.Tech was approved by incorporating suggestions as enclosed in the Annexure-I

Agenda Item No. BoS/2026/CIVIL/3.3: Detailed syllabus for III Year (I & II Sem)

- Dr. A. Ramachandra Murthy suggested inclusion of emerging areas like sustainable materials and advanced structural analysis.

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. G Sarath Chandra	

- Dr. Gangolu Appa Rao recommended strengthening analytical components, For Design of Reinforced Concrete Structures (DRCS), renaming Unit I to Design Concepts, replacing "Philosophy" with "Concepts," expanding WSM, removing Continuous Beams (Unit II) and Analysis (Unit III), and including biaxial column demonstration in Unit IV.
- For Prestressed Concrete, Dr. A. Ramachandra Murthy recommended adding an introduction, renaming Unit I to Prestressing Systems, replacing "Losses" with "Loss," and revising Unit III to include Load Balancing Concepts.
- For Sustainable Construction, Dr. M. Srimurali suggested adding green building rating systems.
- For Transportation Laboratory, Er. K. Sreenivasa Murthy recommended inclusion of CRMB (Crumb Rubber Modified Bitumen) as a specimen.
- For Design of Steel Structures (DSS), Dr. M. Srimurali suggested removing "Introduction" in Unit-1 adding Connections, and removing Built-up Beams in Unit IV.
- For Environmental Engineering (EE), Er. K. Sreenivasa Murthy recommended adding Source, Quality, and Sequence in Unit II, replacing the Hardy Cross Method with simple and complex networks in Unit IV, and corrected textbook names.
- For Bridge Engineering, Dr. Gangolu Appa Rao suggested keeping theory only for composite bridges in Unit IV
- For ETABS Laboratory, N. Sarath Chandra emphasized manual checking for ETABS lab experiments.
- For EE Laboratory, Er. K. Sreenivasa Murthy suggested including P_H and TDS experiments.

Resolution:

The syllabus was thoroughly reviewed and approved with necessary modifications to meet **real-world requirements**, enhance **industry relevance**, and align with the objectives of the **National Education Policy (NEP) 2020**.

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. G Sarath Chandra	

The revisions focus on improving analytical skills, incorporating emerging areas, strengthening practical exposure, and ensuring outcome-based education. The updated and approved syllabus is enclosed in **Annexure-II**.

Agenda Item No. BoS/2026/CIVIL/3.4: DAB & PAC discussion

The Board discussed the effective implementation and strengthening of the Department Advisory Board (DAB) to ensure continuous academic improvement and alignment with institutional goals.

Dr. M. Srimurali emphasized the need for continuous assessment, systematic target setting, and effective outcome-based monitoring through the Program Assessment Committee (PAC). He further suggested periodic reviews, documentation of outcomes, and corrective measures to enhance the overall quality of teaching–learning processes and student performance.

Agenda Item No. BoS/2026/CIVIL/3.5: Approval of Subject Experts panel

The panel was thoroughly reviewed and discussed by the Board members, and after due consideration, it was **unanimously approved**. The finalized panel of subject experts is enclosed in **Annexure-III** for reference.

Agenda Item No. BoS/2026/CIVIL/3.6: Curriculum feedback discussion

Feedback from stakeholders was analyzed.

Mr. N. Sarath Chandra emphasized aligning curriculum with industry requirements.

Er. K. Sreenivasa Murthy suggested increasing site exposure and internships.

The Board resolved to incorporate feedback in curriculum revisions such as Engineering Work shop, AI Assisted Building Planning and Estimation Laboratory and Teckla software.

Agenda Item No. BoS/2026/CIVIL/3.7: Any other item

No additional items were discussed.

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. G Sarath Chandra	

The Chairperson thanked all the members, especially the external experts and industry representatives, for their valuable suggestions and active participation.

The meeting concluded on a productive and constructive note that inhibits skill, attitude and Knowledge to the students towards sustainability.

Attendance Sheet:

BoS Members:

Sl.No		Role in BoS	Signature with Date
1	Dr. N.R. Gowthami ,Assistant Professor& Head, Dept of Civil Engineering,Annamacharya University Rajampet. Ph: 8985515900 Email:nrg@aitsrajampet.ac.in	Chairperson	
2	Dr. S. Venkata Vara Prasad ,Assistant Professor, Dept of Civil Engineering, Annamacharya University,Rajampet. Ph: 8309414515, Email: svvp@aitsrajampet.ac.in	Senior Faculty – Member	
3	Mr. B Raghunatha Reddy,Assistant Professor, Dept of Civil Engineering, Annamacharya University, Rajampet.- Ph: 78933 22879, Email: brr@aitsrajampet.ac.in	Course Coordinator-Member	5/5/26
4	Mr. D Rama Bhupal Reddy ,Assistant Professor, Dept of Civil Engineering,Annamacharya University, Rajampet. Ph: 7989320209 Email:ramabhupalreddy1@gmail.com	Course Coordinator-Member	
5	Dr. Gangolu. Appa Rao ,Professor, Dept. of Civil Engg., IIT, Madras, ChennaiPh: 9444047421.Email: garao@iitn.ac.in	Subject Expert – Member	
6	Dr. A. Ramachandra Murthy ,Senior Principal Scientist, CSIR- SERC, Chennai.Ph:9445339510 Email: murthyarc@serc.res.in	Subject Expert – Member	
7	Dr. M. Srimurali ,Professor, Dept. of Civil Engineering, SV U College of Engineering , Tirupati - ph:9603078920 Email :msrimurali@gmail.com	University Nominee-Member	
8	Er. K.Sreenivasa Murthy ,Executive Engineer , Roads & buildings, Kadapa,Ph: 9440466250 Email: ksmurthy.Seenu@gmail.com	Industry Representative – Member	
9	Mr. N Sarath Chandra ,Managing Director , Ravi Builders and Planners, Rajampet.Ph-906949222 Email :sarathchandra9222@gmail.com	Alumni Representative - Member	G. Sarath Chandra

CHAIRMAN-BOS
CE Dept., AU, Rajampet.

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. G Sarath Chandra	

ANNAMACHARYA UNIVERSITY

EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Rajampet, Kadapa District, A.P – 516126, INDIA

ANNEXURE-III

Civil Engineering- Subject Expert List Civil Engineering-III B.Tech-I SEM

S.No	Subject Title & Code	Subject Expert Name	Designation	Address	Phone No	E-Mail Address
1	24ACIV51T-Design of RCC Structures	Dr P.Kishore Kumar Reddy	Associate Professor	Malla Reddy Engineering College and Management Sciences, Kistapur Medchal,Telangana	9705558182	pkkrnitc@gmail.com
2		Dr.G.Chennakesava Reddy	Associate Professor	KSRMCE (A) Kadapa	9182477938	gadikota.chenna@gmail.com
3		Dr. Y Sudharsan Reddy	Associate Professor	Sai Rajeswari institute of technology, Lingapuram, Proddatur	8886502038	yenugusudharshan@gmail.com
4		Dr. V Sai Neeraja	Associate Professor	CBIT(A), Proddatur	9640776309	saineeraja6@gmail.com
5		Dr. Y. Murali Krishna	Assistant Professor	Bapatla Engineering College, GBC Rd, Mahatmajipuram, Bapatla,	9912858193	phd.bec21@gmail.com
1	24ACIV52T-Geotechnical Engineering	Mrs. S. Jyothirmayee	Assistant Professor	JNTUA College of Engineering Pulivendula	99631 16433	jyothisirigireddy16.ce@jntua.ac.in
2		Dr. Y Sudharsan Reddy	Associate Professor	Sai Rajeswari institute of technology,	8886502038	yenugusudharshan@gmail.com
3		Mr. K. Balanagaiah	Assistant Professor	SRIT,PRODDATUR	8897112656	kogatambalu007@gmail.com
4		Dr. S. Sruthi	Associate Professor	CBIT(A), Proddatur	93618 25436	sruthiscivil@gmail.com
5		Mr. P. Dasthagiri	Assistant Professor	K.S.R.M.C.E., Kadapa	8978044591	poddaturdastagiri1@gmail.com

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. G. Sarath Chandra	

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Civil Engineering- Subject Expert List Civil Engineering-III B.Tech-I SEM

1	24ACIV53T-Transportation Engineering	Mr.P. Pavan Kumar	Assistant Professor	K.S.R.M.C.E Kadapa.	9390316822	pavanpalagiri@ksrmce.ac.in
2		Mr.K.NARESH	ASSISTANT PROFESSOR	PBR Visvodaya Institute Of Technology and Science ,KAVALI, NELLORE	9494811370	NARESH.K@VISVODAYATA.AC.IN
3		Dr.P.Sreenivasulu	Assistant Professor	JNTUH,Hyderabad	9985422760	drsreenu827@gmail.com
4		Miss S. Jasmine	Assistant Professor	AITS kadapa	9398191441	saatika21@gmail.com
5		Miss Are Vigneshwari	Assistant Professor	Siddarth Institute of Engineering & Technology, Puttur,tirupathi, India	8985304743	a.vignupadma@gmail.com
1	24ACIV5AT-Prestressed Concrete	Dr.P.V.Subba Reddy	Professor	NBKRIST, VAKADU	9440126292	pvsreddy1970@gmail.com
2		Dr Selin Ravi Kumar	Professor	Malla Reddy Engineering college, Khompally, Hyderabad,Telangana.	9840202071	dr.selinravikumar@mrec.ac.in
3		Dr.N.Venkata Ramana	Professor	VTU PG Centre, Kalabarugi	9493495295	rccramana@gmail.com
4		Dr. M. Koti Reddy	Professor	CBIT HYDERABAD	9441381396	kotireddycivil@cbit.ac.in
5		Dr T Santhala	Professor	RGM Engineering College, NANDYAL	6304462841	shanthalas30@gmail.com
1	24ACIV5BT-Sustainable Construction Methods	Mrs. T. Madhavi Latha	Assistant Prof	AITS, kadapa	9642691863	madhavilathareddy86@gmail.com
2		Dr M C Venkatasubbaiah	Associate Professor & HoD	St.Peter's Engineering College (Autonomous),Maisammaguda	9985855672	venkat.cct.fus@gmail.com
3		Miss V. Lalitha	Assistant Prof.	Sree Rama Engineering College,Tirupathi	77803 01363	v.lalitha@sreerama.ac.in
4		Mr. Thokalapudi Suresh	Assistant Prof.	JNTUA COLLEGE OF ENGINEERING KALIKIRI	9000505339	sureshjntucek@gmail.com
5		Dr. Daggupati Sridhar	Assistant Professor	Siddarth Institute of Engineering & Technology, Puttur, tirupathi, India	6305311157	sridhar.daggu124@gmail.com

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. N Sarath Chandra	

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Civil Engineering- Subject Expert List Civil Engineering-III B.Tech-ISEM						
1	24ACIV5CT-Ground Improvement Techniques	Dr. G. Sreenivas	Professor	RGM, Nandyal	9502031222	sreenivasulugopu@rgmcet.edu.in
2		Dr K.V.R. Prasad	Professor	GPRCE, Kurnool	9448225772	prasadkvrp@gmail.com
3		Dr. A. Anil	Associate Professor	Annamacharya Institute of Technology, Tirupathi	90000434205	anilachyutha@gmail.com
4		DR. M. Padmaja	Associate Professor	MGIT, Hyderabad	9962433838	padmajamegham@gmail.com
5		Mr. Koppala Siva	Assistant Professor	Department of Civil Engineering, Siddarth Institute of Engi	9441470542	koppalasiva4444@gmail.com

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
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Civil Engineering- Subject Expert List Civil Engineering-III B.Tech-IISEM

S.No	Subject Title & Code	Subject Expert Name	Designation	Address	Phone No	E-Mail Address
1	24ACIV61T-Design of Steel Structures	Dr. M V Ravi Kishore Reddy	Associate Professor	KSRMCE , KADAPA	9032158604	ravikishorereddymv@yahoo.in
2		Dr. Y. Murali Krishna	Assistant Professor	Bapatla Engineering College, GBC Rd, Mahatmajipuram, Bapatla, AP	9912858193	phd.bec21@gmail.com
3		Dr. B Raghunath Reddy	Associate Professor	SRIT, Lingapuram , Proddatur	8008110085	rnreddy.srit@gmail.com
4		Mr. Y. Ravi Reddy	Associate Professor	Bapatla Engineering College, GBC Rd, Bapatla, AP	9849165681	ravireddy29@gmail.com
5		Dr. A Anil	Associate Professor	A.I.T.S., Tirupati	9000434205	anilachyutha@gmail.com
1	24ACIV62T-Environmental Engineering	Dr. M. Padmaja	Assistant professor	MGIT Hyderebad	99624 33838	padmajamegham@gmail.com
2		Dr. Sudheekar Reddy	Assistant professor	SCVE Tirupathi	82979 60423	sudheekar8055@gmail.com
3		Dr. N PALLAVI	Associate Professor	JSS Acedemy of Higher Education & Research, Mysore	9980889207	anupallavi@jssuni.edu.in
4		Dr. R Bhavani	Professor	JNTUA,Anantapuramu	9490981954	rbhavani.civil@jntau.ac.in
5		DR. P. Lakshmi Sruthi	Assistant professor	G.Pulla Reddy Engineering College – Kurnool	8885174575	plakshmisruthi@gmail.com
1	24ACIV63T-Water Resources Engineering	Mr. Srinivasa Murthy M	Professor	Siddarth Institute of Engineering & Technology, Puttur,tirupathi, India	9885255017	srinivasskit@gmail.com
2		Mr. Perumalla Harsha Vardhan	Assistant Professor	MJR ,PILER	8500897957	harshaperumalla33@gmail.com
3		Mr. P. Harshavardhan Reddy	Assistant professor	Vemu institute of technology	7993506520	sivaharsha115@gmail.com
4		Mr. Kalakada Satish	Assistant professor	SVCET, Chittoor	7842294314	Kalakadasatishgeotech@gmail.com
5		Dr.V.Ramesh Babu	Associate Professor	Geethanjali institute of science and technology,Nellore	9441195639	vramesh@gist.edu.in

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. N Sarath Chandra	

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Civil Engineering- Subject Expert List Civil Engineering-III B.Tech-IISEM

1	24ACIV6AT-Bridge Engineering	DR V GIRIDHAR	Professor,	KSRM KADPA	9849499769	drgiridhar@ksrmce.ac.in
2		DR J GURU JAWAHAR	Professor,	AITS TIRUPATHI	9573456235	
3		DR S VINAY BABU	Professor,	G PULLAIAH, KURNOOL	9494483052	vinaysake@gmail.com
4		Dr T Santhala	Professor,	RGM Engineering College, NANDYAL	6304462841	shanthalas30@gmail.com
5		Dr.N.Venkata Ramana	Professor,	VTU PG Centre, Kalabarugi	9493495295	rccramana@gmail.com
1	24ACIV6BT-Foundation Engineering	Mr. K. Jaya Sundar	Assistant Professor	Bapatla Engineering College, GBC Rd, Mahatmajipuram, Bapatla, Andhra Pradesh	8497955620	jayasundar.kommera @becbapatla.ac.in
2		Mr. P. Praveen Kumar	Assistant Professor	Guru Nanak Institute of Technology, RR district,Hyderabad	8500867768	ppraveenkumar.cegnit@gniindia.org
3		Mrs. A. Shirisha Reddy	Assistant Professor	Brilliant Grammar School Educational Society's Group of In	8309962551	siriannepureddy1@gmail.com
4		Mr. Jamkari Arunkumar	Assistant Professor	Narsimha reddy Engineering College	8185875596	arun08jamkari@gmail.com
5		Mrs Nagamala Tharuni	Assistant Professor	Srinivasa Institute of Technology and Science, Kadapa	9398972011	Nagamalatharuni@gmail.com
1	24ACIV6CT-Remote Sensing and GIS	Dr. G. Sreenivas	Professor	RGM, Nandyal	9502031222	sreenivasulugopu@rgmcet.edu.in
2		Dr K.V.R. Prasad	Professor	GPRCE, Kurnool	9448225772	prasadkvrp@gmail.com
3		Dr. A. Anil	Associate Professor	Annamacharya Institute of Technology, Tirupathi	90000434205	anilachyutha@gmail.com
4		DR. M. Padmaja	Associate Professor	MGIT, Hyderabad	9962433838	padmajamegham@gmail.com
5		Dr. C. Chinna Suresh Babu	HOD & Associate Professor	SRIT, PRODDUTUR	9963565837	Suribtech2010@gmail.com

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. N Sarath Chandra	

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DEPARTMENT OF CIVIL ENGINEERING

ANNEXURE-I

III-B.Tech-I SEMESTER / SEMESTER-V

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
			Theory Courses				
1	PC	24ACIV51T	Design of Reinforced Concrete Structures	3	0	0	3
2	PC	24ACIV52T	Geotechnical Engineering	3	0	0	3
3	PC	24ACIV53T	Transportation Engineering	3	0	0	3
4	PE-1	24ACIV5AT	Prestressed Concrete	3	0	0	3
		24ACIV5BT	Sustainable Construction methods				
		24ACIV5CT	Ground Improvement Techniques				
5	OE-1	24ACIV5DT	MOOC (Self -Disciplinary)	3	0	0	3
6	PC	24ACIV51L	Analysis and Design of structures Laboratory -I (Staad Pro/AI)	0	0	3	1.5
7	PC	24ACIV52L	Geotechnical Engineering Laboratory	0	0	3	1.5
8	PC	24ACIV53L	Transportation Engineering Laboratory	0	0	3	1.5
9	SEC	24ACIV55L	Civil Engineering Workshop	1	0	2	2
10	MC	24AMBA51T	Technical Paper Writing and IPR	3	0	0	0
11	Internship	24ACIV57I	Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester)	0	0	0	2
						Total credits	**23.5**

Category	Credits
Professional core Courses (PC)	13.5
Professional Elective courses (PEC)	3
Open Elective Course (OEC)	3
Skill Enhancement course (SEC)	2
Mandatory Course(MC)	0
Summer Internship (I)	2
Total Credits	**23.5**

III-B.Tech-II SEMESTER / SEMESTER-VI

Sl.No.	Category	Course Code	Course Title	Hours per week	Credits

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. G.Sarath Chandra	

DEPARTMENT OF CIVIL ENGINEERING

				L	T	P	C
Theory Courses							
1	PC	24ACIV61T	Design of Steel Structures	3	0	0	3
2	PC	24ACIV62T	Environmental Engineering	3	0	0	3
3	PC	24ACIV63T	Water Resources Engineering-I	3	0	0	3
4	PE-2	24ACIV6AT	Bridge Engineering	3	0	0	3
		24ACIV6BT	Foundation Engineering				
		24ACIV6CT	Remote Sensing and GIS				
5	OE-2	24ACIV6DT	MOOC(Inter-Disciplinary)	3	0	0	3
6	PC	24ACIV61L	Analysis and Design of structures Laboratory -II(E Tabs)	0	0	3	1.5
7	PC	24ACIV62L	Environmental Engineering Laboratory	0	0	3	1.5
8	PC	24ACIV64L	AI-Assisted Building Planning and Estimation Laboratory	1	0	1	1.5
9	SEC	24AENG61L	Soft Skills	0	1	2	2
10	MC	24AAUD61T	Gender Sensitization	2	0	0	0
						Total credits	**21.5**
Industrial/Research Internship (Mandatory) 2 Months during summer vacation							

Category	Credits
Professional core Courses (PC)	13.5
Professional Elective courses (PEC)	3
Open Elective Course (OEC)	3
Skill Enhancement course (SEC)	2
Mandatory Course (MC)	--
Industrial/Research Internship (Mandatory) 2 Months	--
Total Credits	**21.5**

Dr. N.R. Gowthami	Dr. S. Venkata Vara Prasad	Mr. B Raghunatha Reddy	Mr. D Rama Bhupal Reddy	Dr. Gangolu. Appa Rao
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ANNAMACHARYA UNIVERSITY

EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

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DEPARTMENT OF CIVIL ENGINEERING

IV-B.Tech-I SEMESTER / SEMESTER-VII

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
			Theory Courses				
1	PC	24ACIV71T	Engineering Estimation Costing & Valuation	3	0	0	3
2	PE-3	24ACIV7AT	Advanced Structural Analysis	3	0	0	3
		24ACIV7BT	Project Management and Control				
		24ACIV7CT	Design and Drawing of Irrigation Structures				
3	PE-4	24ACIV7DT	Rehabilitation and Retrofitting of Structures	3	0	0	3
		24ACIV7ET	Sanitary Engineering				
		24ACIV7FT	Water Resource Engineering-II				
4	PE-5	24ACIV7GT	Finite Element Methods for Civil Engineering	3	0	0	3
		24ACIV7HT	Advanced Environmental Engineering				
		24ACIV7IT	Railway Engineering				
5	OE-3	24ACIV7JT	Disaster Management	3	0	0	3
		24ACIV7KT	Water Resources and Harvesting				
		24ACIV7LT	IoT Applications in Civil Engineering				
	OE-4	24AMEC7HT	Optimization Techniques	3	0	0	3
		24AMEC7GT	Entrepreneurship Development				
		24AEEE7TT	Sustainable Energy Sources				
		24AEEE7UT	Electric Vehicles				
		24AECE7TT	Introduction to Image Processing				
		24AECE7UT	Introduction to Micro Processors and Micro Controllers				
		24AMBA71T	Human Resource Management				
		24AMBA72T	Startup Management				
		24ACSE7QT	Data Base Management Systems				
		24ACSE7RT	Operating Systems				
		24AMAT71T	Numerical Methods				
		24ACHE71T	Chemistry of Energy Systems				
		24APHY71T	Smart Materials and Devices				
7	Internship	24ACIV7I	Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester	0	0	0	2
						Total credits	**20**

Category	Credits
Professional core Courses (PC)	3
Professional Elective courses (PEC)	9
Open Elective Course (OEC)	6
Industrial/Research Internship	2
Total Credits	**20**

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Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. N Sarath Chandra	

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DEPARTMENT OF CIVIL ENGINEERING

IV-B.Tech-II SEMESTER / Semester VIII

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	PW	24ACIV8P	Project work and Internship	-	-	-	12
Internship (2 months)							
						Total credits	12

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Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. N Sarath Chandra	

ANNEXURE - II

DEPARTMENT OF CIVIL ENGINEERING

Title of the Course:		**Design of Reinforced Concrete Structures**
Category	:	PC
Year	:	III
Semester	:	I
Course Code	:	24ACIV51T
Branch/es	:	CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. Understand the fundamental methods of concrete structure design, including elastic, ultimate load, and limit state methods.
2. Analyze and design reinforced concrete beams, slabs, staircases, columns, and footings using the Limit State Method as per IS codes.
3. Evaluate the behavior of reinforced concrete members in terms of flexure, shear, torsion, bond and anchorage.
4. Apply design principles to ensure serviceability and safety of concrete structures under various loading conditions.
5. Develop skills to use design aids and professional software for the analysis and design of RC structures.

Course Outcomes:

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

1. Understand the design philosophy of reinforced concrete structures including Working Stress Method and Limit State Method as per IS 456:2000.
2. Analyze and design singly and doubly reinforced beams for flexure, shear, bond and torsion using Limit State Method.
3. Design one-way, two-way, cantilever and continuous slabs under various boundary conditions.
4. Design short rectangular and circular columns subjected to axial load, uniaxial and biaxial bending.
5. Design isolated footings and evaluate serviceability requirements such as deflection and cracking, including staircase design.

Unit 1 Design Concepts **8**

Behavior of Plain and RC Beams, Introduction to Materials, recommendation in IS 456 – 2000, grades of concrete, Basic statistical principles – Characteristic loads– Characteristic strength – Partial load and safety factors – representative stress-strain curves for cold worked deformed bars and mild steel bars. Design Philosophy: Elastic Method, Ultimate Load Method and Limit State Method- Advantages – Assumptions, Design of Singly Reinforced Beam by Working Stress Method.

Unit 2 Design of Beams 9

Limit State Philosophy as Detailed in IS Code - Analysis and Design of Singly, Doubly Reinforced Rectangular and Continuous Beams. Design of RC Members for Bond, Shear and torsion.

Unit 3 Design of Slabs **16**

Design of One Way and Two Way slabs subjected to various Boundary Conditions, Stair Cases: Classification, Design of Dog-Legged Staircase.

Unit 4 Design of Columns **12**

Classification of Columns – Design of Short Rectangular Columns for Axial, Uniaxial and Biaxial Bending demo.

Unit 5 Design of Footings & Serviceability **10**

Footings – Design of Isolated - Flat and Sloped Footings.

Serviceability: Design for Deflection and Cracking,

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DEPARTMENT OF CIVIL ENGINEERING

Prescribed Textbooks:

1. Limit State Design by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi

Reference Books:

1. Design of Reinforced Concrete Structures, by Gambhir .M.L, Prentice Hall of India, Pvt. Ltd., New Delhi, 2008
2. "Code of Practice for Plain and Reinforced Concrete", BIS, New Delhi, IS456-2000.
3. Relevant IS codes such as IS 875, ,IS 3370(Part-IV), BIS 2000, SP-16.
4. Structural Design and Drawing by N.Krishna Raju, University Press, Hyderabad.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV51T.1	3	2	1	–	–	–	1	–	–	–	2	3	1
24ACIV51T.2	3	3	3	1	1	–	1	–	–	–	2	3	2
24ACIV51T.3	3	3	3	1	1	–	1	–	–	–	2	3	2
24ACIV51T.4	3	3	3	1	1	–	1	–	–	–	2	3	2
24ACIV51T.5	3	2	3	1	1	1	1	–	–	1	2	2	3

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **Geotechnical Engineering**

Category : PC
Year : III
Semester : I
Course Code : 24ACIV52T
Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification.
2. To familiarize the students about the fundamental concepts of flow through soil
3. To familiarize the students about the fundamental concepts of stress transformation, stress distribution
4. To familiarize the students about the fundamental concepts of compaction and consolidation
5. To familiarize the students about the fundamental concepts of shear strength of soils.

Course Outcomes:

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

1. Understand the Index properties of soils such as phase relationships, unit weight, water content, grain size distribution, index properties, methods of soil classifications and compaction characteristics in soils and classify the soils.
2. Understand the concepts of total, neutral and effective stress in soils, principles of Darcy's law, permeability and seepage in soils and their effects in engineering applications.
3. Understand the concepts of stress distribution under varying load conditions and the application of Boussinesq's and Westergaard's theories for finding stress distribution in soils.
4. Understand the Terzaghi's theory of primary consolidation, settlement in soils and associated properties.
5. Understand the shear stress and shear strength properties in soils, Mohr diagrams, shear strength tests

Unit 1 Soil Index Properties **13**

Phase Diagram, Void ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Moisture content, Specific gravity, Bulk density, Dry density, Saturated density, Submerged density and their interrelationships -clay mineralogy and soil structure. Significance and Laboratory determination -Water content, Specific Gravity, Particle size distribution (Sieve analysis and Hydrometer analysis), Relative density, Consistency limits and their indices, in-situ density, Activity of Clay, Thixotropy of clay, IS classification - Plasticity chart and its importance.

Unit 2 Permeability & Seepage **10**

Permeability: Types of soil water – capillary rise – flow of water through soils – Darcy's law- permeability – Factors affecting permeability – laboratory determination of coefficient of permeability –Permeability of layered systems.

Seepage: Seepage velocity, Seepage pressure, seepage through soils- total, neutral and effective stresses – quick sand condition, flow net: characteristics and uses, numerical problems.

Unit 3 Stress Distribution in Soils **11**

Estimation of stresses in soils – Boussinesq's theory for point loads, stress distribution in different loaded areas-line load, uniformly loaded circular, strip footing. Westergaard's theory, pressure bulb, variation of vertical stress under point load along the vertical and horizontal planes – Newmark's influence chart

Unit 4 Compaction and Consolidation **12**

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties – Field compaction Equipment – compaction control

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DEPARTMENT OF CIVIL ENGINEERING

Consolidation: Types of Compressibility – Immediate settlement – Primary consolidation and secondary consolidation – Stress history of clay, normally consolidated soil, over consolidated soil and under consolidated soil- preconsolidation pressure and its determination- Estimation of settlements -Terzaghi's 1-D consolidation theory – Coefficient of consolidation and its determination.

Unit 5 Shear Strength of Soils **10**

Definition and use of shear strength - Normal and Shear stresses on a plane – Mohr's stress circle- Mohr-Coulomb failure theory- Measurement of shear strength -Direct shear test, Tri-axial shear test, Unconfined compression test and vane shear test – shear strength of granular soil, shear strength of clay, Factors affecting shear strength of granular soils and clay, Liquefaction.

Prescribed Textbooks:

1. Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors, Delhi.

Reference Books:

1. Geotechnical Engineering by C. Venkataramiah, New age International Pvt . Ltd, (2002).
2. Soil Mechanics – T.W. Lambe and Whitman, Mc-Graw Hill Publishing Company, Newyork

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV52T.1	3	2	1	2	–	–	-	–	–	1	1	3	1
24ACIV52T.2	3	3	1	2	1	–	-	–	–	1	1	3	2
24ACIV52T.3	3	3	2	2	1	–	-	–	–	1	1	3	2
24ACIV52T.4	3	3	2	2	1	–	-	–	–	1	2	3	2
24ACIV52T.5	3	3	2	2	1	-	-	–	–	1	2	2	3

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course:		**Transportation Engineering**
Category	:	PC
Year	:	III
Semester	:	I
Course Code	:	24ACIV53T
Branch/es	:	CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To understand the history of highway development, surveys and classification of roads.
2. To study about the geometric design of highways, traffic characteristics and design of intersections
3. To understand the traffic engineering rules and regulations
4. To know about the pavement materials and mix design.
5. To understand the different pavement designs

Course Outcomes:

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

1. Understand the classification of roads, highway development in India, planning process, alignment and road network patterns.
2. Apply geometric design principles for highway cross sections, sight distance, horizontal and vertical curves, super elevation and transition curves.
3. Analyze traffic characteristics, conduct traffic studies, design traffic signals, and apply traffic control devices for road safety.
4. Identify and evaluate pavement materials such as soils, aggregates, bitumen and cement concrete using standard tests.
5. Design flexible pavements using CBR, GI and triaxial methods and understand pavement component functions.

Unit 1 Highway Development and Planning **10**

Introduction - Classification of roads, road development in India, Current Road projects in India; highway alignment - Factors affecting, project preparation. Road Network Patterns - Engineering Surveys – Drawings and Reports.

Unit 2 Geometric Design of Highways 11

Introduction; highway cross section elements; sight distance, Gradients, Grade Compensation, Design - horizontal alignment, Vertical alignment, Super elevation, Extra widening and Curves.

Unit 3 Traffic Engineering **12**

Basic Parameters of Traffic-Volume, Speed and Density – inter relation - Traffic Volume Studies- Data Collection and Presentation-speed studies - Parking Studies and Parking characteristics- Road Accidents-Causes and Preventive measures- Accident Data Recording – Condition Diagram and Collision Diagrams-Road Traffic Signs – Types and Specifications, Road Markings - Necessity, Types and Specifications, Design of Traffic Signals (Webster's Method).

Unit 4 Pavement Materials and Mix Design **12**

Introduction- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, Bitumen Mix Design.

Unit 5 Pavement Design **13**

Types of pavements – Difference between flexible and rigid pavements – Pavement Components – Sub grade, Sub base, base and wearing course, Design of Flexible pavement – G.I method, CBR Method, Tri-axial

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method, Design of Rigid pavements – Critical load positions - Westergaard's stress equations - stresses in rigid pavements – Design of Expansion and contraction joints in CC pavements - Numerical examples.

Prescribed Textbooks:

1. Highway Engineering – S.K.Khanna & C.E.G. Justo, Nemchand & Bros., 7th edition (2000).

Reference Books:

1. Highway Engineering – S.P.Bindra ,DhanpatRai& Sons. – 4th Edition (1981)
2. Traffic Engineering & Transportation Planning – Dr.L.R.Kadyali, Khanna publications – 6th Edition.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV53T.1	3	2	1	1	1	2	-	–	1	–	2	2	2
24ACIV53T.2	3	3	3	2	2	2	-	–	1	–	2	3	2
24ACIV53T.3	3	3	2	2	2	3	1	1	2	–	2	2	3
24ACIV53T.4	3	2	1	2	2	1	-	1	1	1	2	3	2
24ACIV53T .5	3	3	3	2	2	2	-	–	1	–	2	3	3

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **Prestressed Concrete**

Category : PE

Year : III

Semester : I

Course Code : 24ACIV5AT

Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. Understand the principles, methods, and materials used in prestressed concrete.
2. Analyze various losses of prestress in both pre-tensioned and post-tensioned members.
3. Design prestressed concrete beams considering flexure and shear forces.
4. Deign deflections in prestressed concrete structures and their controlling factors.
5. Analyze the behavior of composite beams under different loading conditions.

Course Outcomes:

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

1. Explain the principles and methods of prestressing and the need for high-strength materials.
2. Analyze the different types of prestress losses and their impact on structural performance.
3. Design prestressed concrete beams considering flexural and shear stresses.
4. Evaluate deflections in prestressed beams and suggest control measures.
5. Analyze the stress distribution and differential shrinkage in composite beams.

Unit 1 Prestressing systems **11**

Introduction, Principles of Pre-Stressing, Prestressing Systems – Pre-Tensioning and Post-Tensioning-Advantages and Limitations, Need for High Strength Materials. Methods - Pre-Tensioning (Hoyer System) and Post-Tensioning Methods (Freyssinet System and Gifford- Udall System).

Unit 2 Loss of Pre-stress 10

Loss of Pre-Stress in Pre-Tensioned and Post-Tensioned Members - Elastic Shortening, Shrinkage and Creep of Concrete, Relaxation of Stress in Steel, Anchorage Slip and Frictional Losses.

Unit 3 Analysis and design for Flexure and Shear 12

Analysis of Beams for Flexure and Shear - Straight, Concentric, Eccentric, Bent and Parabolic Tendons- Kern Line - Cable Profile, load balancing concept Design of PSC Beams (Rectangular and I Sections) Using IS 1343. Introduction to Transmission Length and End Block.

Unit 4 Deflections 13

Control of Deflections- Factors Influencing Deflection - Short Term Deflection of Uncracked Beams, Prediction of Long Time Deflection.

Unit 5 Composite beams 11

Propped and Un-Propped, Stress Distribution, Differential Shrinkage, Analysis of Composite Beams.

Prescribed Textbooks:

1. Prestressed Concrete by N. Krishna Raju, Tata McGraw Hill Publications 7th edition 2025
2. Prestressed concrete by N.Rajagopalan, Narosa Publishing House 2nd edition 2017

Reference Books:

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1. Design of Prestressed Concrete Structures by T.Y. Lin & Ned H. Burns, John Wiley & Sons 3rd edition 2010
2. Prestressed Concrete Design by Praveen Nagrajan, Pearson publications, 2013.
3. Prestressed Concrete by Ramamuratam, Dhanpatrai Publications 2020 edition
4. BIS code on —prestressed concretel, IS: 1343 to be permitted into the examination Hall

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV5AT.1	2	1	1	-	-	1	-	-	1	-	1	3	1
24ACIV5AT.2	2	2	1	1	2	-	-	-	-	-	1	3	2
24ACIV5AT.3	2	2	3	2	2	-	1	-	-	-	1	3	3
24ACIV5AT.4	2	1	2	2	3	1	-	-	-	-	1	2	3
24ACIV5AT.5	2	2	2	1	2	1	-	-	-	-	1	2	2

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **Sustainable Construction Methods**
Category : PE
Year : III
Semester : I
Course Code : 24ACIV5BT
Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To introduce the fundamentals of sustainability and green building concepts.
2. To understand green building practices, rating systems, and energy-efficient strategies.
3. To develop knowledge of energy-efficient green building design and renewable energy integration.
4. To gain insight into efficient HVAC systems and sustainable building services.
5. To understand material conservation, waste management, and indoor environmental quality in buildings.

Course Outcomes:

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

1. Understand the Concept of Green Building materials and Sustainable Features
2. Understand the Green Building concepts and practices in India.
3. Reduce Energy Demand and Use Onsite Sources.
4. Design and modeling of air conditioning Interior lighting systems.
5. Understand the material conservation handling of non-process wastes in Green Building.

Unit 1 Sustainability **9**

Green Buildings - Definition, Need, benefits, Materials and Equipment in India, Key Requisites and Important Sustainable features.

Unit 2 Green Buildings and Practices **13**

Green Buildings - Movement in India, Benefits, Opportunities, Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings, Rating Systems - Residential Sector, Market Transformation, LEED India Rating System.

Unit 3 Green Building Design **12**

Reduction in Energy Demand, Onsite Sources and Sinks, Maximize System Efficiency, Steps to Reduce Energy,
Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources. Ecofriendly captive power generation for factory, Building requirement.

Unit 4 Heat Ventilation and Air Conditioning System **13**

CII Godrej Green business center, Design philosophy, Design interventions, Energy modeling, HVAC System design, Chiller selection, pump selection, Selection of cooling towers, Selection of air handing units, Precooling of fresh air, Interior lighting system, Key feature of the building. Eco-friendly captive power generation for factory, Building requirement. Use of Geothermal Energy for Cooling and heating structures..

Unit 5 Material Conservation and Indoor Environment Quality (IEQ) **12**

Waste reduction during construction, materials with recycled content, local materials, material reuse, certified wood, Rapidly renewable building materials and furniture.
Indoor Environment Quality And Occupational Health: Air conditioning, Indore air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building,

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improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels.

Prescribed Textbooks:

1. Sustainable Building Design Manual Part-1 & Part-2, The Energy and Resources Institute, TERI- 2004
2. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.

Reference Books:

1. Green Building Hand Book by Tomwoolley and Samkimings, 2009.
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV5BT.1	3	2	1	1	-	2	-	-	-	-	1	2	1
24ACIV5BT.2	3	2	1	1	-	1	-	-	-	-	1	2	1
24ACIV5BT.3	3	3	3	2	-	1	-	-	-	-	1	2	2
24ACIV5BT.4	3	2	3	2	-	1	-	-	-	-	1	1	3
24ACIV5BT.5	3	2	2	2	-	1	-	-	-	-	1	2	2

DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **Ground Improvement Techniques**

Category : PE

Year : III

Semester : I

Course Code : 24ACIV5CT

Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. Provide fundamental knowledge on the formation and development of ground, including soil formation, soil profiles, soil distribution in India, reclaimed soils, and offshore deposits.
2. Enable students to understand the mechanics of soil compaction, field compaction procedures, selection of appropriate compaction methods, and quality control techniques.
3. Develop the ability to analyse seepage and groundwater behaviour and to design effective drainage and dewatering systems for geotechnical engineering applications.
4. Introduce ground improvement techniques such as vibration methods, grouting, and injection, and their suitability for different soil conditions.
5. Familiarize students with geosynthetics and soil stabilization methods (mechanical, cementing, bituminous, and chemical) to enhance soil performance in civil engineering projects.

Course Outcomes:

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

1. Demonstrate the formation and development of ground, including soil formation, soil profiles, soil distribution in India, reclaimed soils, offshore deposits, and assess ground improvement potential.
2. Analyse soil compaction mechanisms and select appropriate field compaction methods with proper quality control measures.
3. Evaluate seepage, groundwater behaviour, and design suitable drainage and dewatering systems for construction projects.
4. Apply vibration methods and grouting/injection techniques for ground improvement based on soil conditions and project requirements.
5. Select and apply geosynthetics and soil stabilization techniques (mechanical, cementing, bituminous, and chemical) to improve soil performance in geotechnical engineering applications.

Unit 1 Formation and Development of Ground **10**

Introduction, Formation of Rock and Soil Profile, Soil Distribution in India, Alterations of Ground after formation, Reclaimed Soils, Natural Offshore Deposits, Ground Improvement Potential

Unit 2 Compaction 8

Introduction, Compaction Mechanics, Field Procedure, Surface Compaction, Selection of Field Compaction Procedures, Compaction Quality Control.

Unit 3 Drainage Methods **9**

Introduction, Seepage, Filter Requirements, Groundwater, Groundwater and Seepage Control, Methods of Dewatering Systems, Design Steps for Dewatering Systems, Drains.

Unit 4 Vibration Methods, Grouting and Injection 10

Vibration Methods-Introduction, Vibro compaction, Vibro displacement compaction

Grouting and Injection - Introduction, aspects of grouting, grouting procedure, applications

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Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. N Sarath Chandra	

Unit 5 Geosynthetics, Stabilization Techniques **11**

Geosynthetics - Introduction, types, properties and applications.

Stabilization Techniques -Introduction, requirements of soil stabilization, mechanical, Cementing, bituminous and chemical stabilization.

Prescribed Textbooks:

1. Ground Improvement Techniques by Dr. P. Purushotham Raj. Laxmi Publications, New Delhi University science press, New Delhi 2nd edition 2016

Reference Books:

1. Ground Improvement, Moseley M.P. Blackie Academic and Professional, Boca Taton, Florida, USA (1993).
2. Ground Improvement Techniques, Nihar Ranajan Patra Vikas Publications, New Delhi
3. Ground Control and Improvement, Xanthakos P.P, Abramson, L.W and Brucwe, D.A (1994) John Wiley and Sons, New York, USA.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV5CT.1	3	2	1	1	–	–	–	–	–	–	1	3	2
24ACIV5CT.2	3	3	2	2	2	–	–	–	–	–	1	3	2
24ACIV5CT.3	3	3	3	2	2	–	–	–	–	–	1	3	2
24ACIV5CT.4	3	3	2	2	2	–	–	–	–	–	2	3	2
24ACIV5CT.5	3	3	3	2	3	2	–	–	–	–	3	3	3

DEPARTMENT OF CIVIL ENGINEERING

Title of the Course	:	Analysis and Design of structures Lab-I (STAAD Pro.)
Category	:	PC
Year	:	III
Semester	:	I
Course Code	:	24ACIV51L
Branch/es	:	CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

1. Provide fundamental knowledge of Auto CAD and Tekla for 2D drafting and 3D modeling.
2. Train students in structural analysis and design using STAAD.Pro
3. Develop skills in reinforcement detailing and structural component modeling.
4. Introduce seismic and nonlinear analysis for structural safety evaluation.
5. Enable students to apply civil engineering software tools for real-world projects.

Course Outcomes:

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

1. Create 2D drawings and structural detailing using AutoCAD.
2. Develop 3D building models and analyze site topography in Revit.
3. Perform structural analysis and design of multi-story buildings using STAAD.Pro and ETABS.
4. Conduct seismic and performance-based analysis for high-rise structures.
5. Apply SAP2000 for bridge modeling, water tank design, and advanced structural systems.

List of Experiments: -

1. Introduction to STAAD Pro
2. Analysis & design of Continuous beam
3. Analysis and Design of 2D Frame
4. Analysis and Design of 3D frames
5. Analysis and Design of Two-way slab
6. Analysis and Design of Retaining wall
7. Analysis of 3D Steel truss
8. Analysis and Design of Water tank
9. Analysis and Design of a Building for Wind & earthquake load application
10. Analysis and Design of Deck Slab Bridge.

Note- 8 Experiments out of 10 should be conducted mandatorily

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Dr. A. Ramachandra Murthy	Dr. M. Srimurali	Er. K.Sreenivasa Murthy	Mr. N Sarath Chandra	

DEPARTMENT OF CIVIL ENGINEERING

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV51L.1	3	1	2	–	3	–	–	1	2	1	2	2	2
24ACIV51L.2	3	2	2	–	3	1	–	1	2	1	2	2	3
24ACIV51L.3	3	2	3	1	3	–	–	1	2	2	2	3	3
24ACIV51L.4	3	2	3	1	3	–	–	1	2	2	2	3	2
24ACIV51L.5	3	3	3	2	3	1	1	1	2	2	2	3	3

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **Geotechnical Engineering Laboratory**

Category : PC

Year : III

Semester : I

Course Code : 24ACIV52L

Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

1. To determine the index properties of soils such as specific gravity, grain size distribution, and Atterberg limits for soil classification.
2. To evaluate in-situ density and compaction characteristics of soils using field and laboratory compaction methods.
3. To determine permeability characteristics of soils using constant head and falling head methods.
4. To assess shear strength parameters of cohesive and cohesionless soils using laboratory tests.
5. To evaluate bearing capacity characteristics of subgrade soil using California Bearing Ratio (CBR) test.

Course Outcomes:

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

1. Determine index properties of soil, including specific gravity, grain size distribution, and consistency limits.
2. Conduct field and laboratory compaction tests to evaluate the moisture-density relationship of soil.
3. Evaluate permeability and consolidation characteristics of soil using appropriate laboratory techniques.
4. Analyze the shear strength and compressibility of soil through direct shear, unconfined compression, and tri-axial tests.
5. Integrate test results and engineering judgment to interpret soil behavior and make informed decisions in geotechnical engineering applications.

List of Experiments: -

I. Index Properties

1. Determination of Specific Gravity of Soil
2. Grain Size Distribution – Sieve Analysis
3. Grain Size Distribution - Hydrometer Analysis
4. Determination of Liquid Limit and Plastic Limit of a soil sample

II. In-Situ Density and Compaction Characteristics

1. Determination of Field Density by Sand Replacement and Core Cutter Method.
2. Determination of Moisture–Density Relationship using Standard Proctor and Modified Proctor Tests.

III. Engineering Properties

1. Determination of Permeability by Constant Head Method.
2. Determination of Permeability by Falling Head Method.
3. Determination of Shear Strength of Cohesion Less Soil by Direct Shear Test.
4. Determination of Shear Strength of Cohesive Soil by Unconfined Compression Test.
5. Determination of Undrained shear strength of Cohesive Soil by Vane Shear Test.
6. Determination of Bearing Capacity of Subgrade soils by California Bearing Ratio Test (CBR).

Note- 10 Experiments out of 12 should be conducted mandatorily

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DEPARTMENT OF CIVIL ENGINEERING

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV52L.1	3	2	1	3	2	-	–	2	2	–	1	3	3
24ACIV52L.2	3	2	1	3	2	1	–	2	2	1	1	3	3
24ACIV52L.3	3	3	1	3	2	1	–	2	2	1	1	3	3
24ACIV52L.4	3	3	1	3	2	1	–	2	2	1	1	3	3
24ACIV52L.5	3	3	2	3	2	2	1	2	2	1	2	3	3

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **Transportation Engineering Laboratory**

Category : PC
Year : III
Semester : I
Course Code : 24ACIV53L
Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

1. To enable students to perform quality control tests on pavement materials used in highway construction.
2. To help students understand and evaluate physical properties of road aggregates through standard laboratory tests.
3. To provide practical knowledge in testing strength, durability, and shape characteristics of aggregates for pavement applications.
4. To familiarize students with testing procedures and engineering properties of bituminous materials used as binding agents.
5. To develop the ability to interpret test results and assess suitability of pavement materials as per relevant standards.

Course Outcomes:

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

1. Perform quality control tests on pavements and pavement materials.
2. Recognize the knowledge about different physical properties of aggregates by
3. Perform different test on road aggregates.
4. Understand the different important engineering properties of road material for aggregate
5. Understand the different important engineering properties of road material for binding materials.

List of Experiments: -

Road Aggregates:

1. Determination of Aggregate Crushing Value
2. Determination of Aggregate Impact Value
3. Determination of Specific Gravity and Water Absorption of Aggregates
4. Determination of Attrition Value of Aggregates
5. Determination of Abrasion Value of Aggregates (Los Angeles Test)
6. Determination of Shape Characteristics of Aggregates (Flakiness Index & Elongation Index)

Bituminous Materials:

1. Determination of Penetration Value of Bitumen
2. Determination of Ductility of Bitumen
3. Determination of Softening Point of Bitumen (Ring and Ball Method)
4. Determination of Flash and Fire Point of Bitumen

Note- 9 Experiments out of 10 should be conducted mandatorily

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CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV53L.1	2	2	–	2	3	1	1	1	1	–	2	2	3
24ACIV53L.2	2	2	–	2	3	1	1	1	1	–	2	2	3
24ACIV53L.3	2	2	–	2	3	1	1	1	1	–	2	2	3
24ACIV53L.4	3	3	–	2	3	1	1	1	1	–	2	2	2
24ACIV53L.5	3	1	–	2	3	1	1	1	1	–	2	2	3

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course	:	**Civil Engineering Workshop**
Category	:	SEC
Year	:	III
Semester	:	I
Course Code	:	24ACIV55L
Branch/es	:	CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

1. To impart practical knowledge of surveying techniques for field setting out, leveling, and accuracy verification using standard instruments.
2. To develop hands-on skills in basic construction practices such as masonry, plastering, painting, and flooring with proper quality control.
3. To understand the preparation, casting, curing, and testing of construction materials including concrete, soil blocks, and fly ash bricks.
4. To provide exposure to basic building services like plumbing systems, pipe fittings, and leak testing.
5. o enable experimental analysis and visualization of structural systems through determination of properties and model making of structures.

Course Outcomes:

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

1. Apply surveying techniques for accurate field setting out and leveling.
2. Demonstrate masonry, plastering, and finishing works with quality control.
3. Design, prepare, and test construction materials (bricks, concrete, soil blocks).
4. Understand and execute basic building services like plumbing and flooring.
5. Analyze structural behavior through experimental methods and model making.

List of Experiments: -

1. Field Setting Out of a 1BHK Layout Using Tape, Cross Staff and Auto Level with Accuracy Verification
2. Construction of Brick Masonry Corner in English Bond with Mortar and Verticality/Alignment Assessment 1m height
3. Design, Casting, Curing and Quality Assessment of Cover Blocks
4. Preparation, Curing and Compressive Strength Evaluation of Stabilized Soil-Cement bricks.
5. Casting, Curing and Strength Testing of Fly Ash Concrete bricks.
6. Installation, Threading and Leak Testing of Basic Building Plumbing System with Pipe Fittings
7. Surface Preparation, Cement Plaster Application and Painting Operations.
8. Base Preparation, Alignment Control and Laying of Ceramic Tile Flooring over Five Square Meter Area.
9. Determination of Centre of Gravity and Moment of Inertia of Rolled Steel Sections by Experimental Measurements.
10. Model making of different structures like building, bridges and different types of trusses.

Note- 9 Experiments out of 10 should be conducted mandatorily

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CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV64L.1	3	2	1	2	3	1	1	2	-	1	2	2	3
24ACIV64L.2	3	2	2	1	2	2	2	2	-	1	2	2	3
24ACIV64L.3	3	2	3	3	2	1	3	2	1	2	2	1	3
24ACIV64L.4	3	2	2	1	2	3	2	2	1	1	2	1	3
24ACIV64L.5	3	3	2	3	2	1	1	2	2	2	3	2	3

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **Design of Steel Structures**

Category : PC

Year : III

Semester : II

Course Code : 24ACIV61T

Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To understand the properties of structural steel and the principles of Limit State Design as per relevant IS codes.
2. To analyze and design welded and bolted connections considering strength, efficiency, and practical applications.
3. To design tension members including various sections, net effective area, and lug angles.
4. To design compression members such as columns (simple and built-up) considering end conditions and buckling effects.
5. To design steel beams and plate girders including laterally supported and unsupported beams, built-up sections, and stiffeners as per IS code provisions.

Course Outcomes:

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

1. Design the welded and bolted connections.
2. Design the tension members.
3. Design the compression members.
4. Design the laterally restrained and unrestrained beams and plate girder.
5. Design the slab and gusset bases for the columns.

Unit 1 Welded & Bolted Connections **12**

Introduction-Types of Steel, Section Classifications, Properties of Structural Steel - I.S. Rolled steel Sections - Concept of Limit State Design.

Connections- Advantages and disadvantages of welding- Strength and efficiency of welds-Butt and fillet welds, eccentric welded connections, Strength and efficiency of Bolted connections.

Unit 2 Design of Tension Members 11

Types of sections – effective section for angles and tees in tension – Design of Tension member-Lug angles.

Unit 3 Design of compression members **20**

Compression Members: Simple and built up compression members – Assumptions regarding end conditions – Design of built up columns with battens and laces.

Unit 4 Design of Beams and Plate Girder 16

Beams: Allowable stresses – Design requirements as per IS Code – Design of beams with restrained and unrestrained compression flanges –Plate Girder-Design considerations-IS code recommendations–Design of welded plate girder – End bearing stiffeners– Intermediate bearing stiffeners.

Unit 5 Column Bases 11

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DEPARTMENT OF CIVIL ENGINEERING

Design of Slab and Gusseted bases for Columns.

Prescribed Textbooks:

1. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 2010

Reference Books:

1. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2013.
2. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi, 2017

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV61T.1	3	1	3	–	2	1	-	2	1	–	1	3	2
24ACIV61T.2	3	2	3	–	2	1	-	2	1	-	1	3	2
24ACIV61T.3	3	3	3	–	2	1	-	2	1	-	1	3	2
24ACIV61T.4	3	3	2	-	2	1	-	2	–	2	1	3	2
24ACIV61T.5	3	3	3	-	2	1	-	2	–	2	1	3	2

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **Environmental Engineering**

Category : PC
Year : III
Semester : II
Course Code : 24ACIV62T
Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To understand the need for protected water supply systems and to estimate water demand based on population forecasting and consumption patterns.
2. To analyze water quality parameters and identify suitable water sources, along with methods of collection and conveyance.
3. To understand and design various water treatment processes including sedimentation, filtration, disinfection, and softening.
4. To develop skills in planning and analysis of water distribution systems, including storage, network analysis, and system components.
5. To understand the causes, impacts, and control measures of air and noise pollution along with relevant standards and indices..

Course Outcomes:

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

1. Estimate the water demand considering future projection of population.
2. Evaluate various sources of water in terms of quantity and quality.
3. Analyze and design unit operation of water treatment units.
4. distribute the treated water to public including pipe network.
5. understand the different aspects of Air & Noise pollution.

Unit 1 Introduction and Water Demand **11**

Introduction: Need for protected water supply – Objectives of water supply systems – Water borne diseases and their control. Quantity: Design period – Population forecast – Rate of consumption for various purposes – Fluctuations in demand – Factors governing the rate of demand – Fire demand.

Unit 2 Water sources , Quality, , collection and conveyance **9**

Sources of Water Supply: Classification – Suitability of sources with reference to quantity and quality – Infiltration galleries and wells – choice of source

Quality: Sampling – Routine water analysis for physical, chemical and bacteriological characteristics and their significance – Water quality index – Standards for drinking water.

Collection and Conveyance: Intake structures – Lake, canal, river and reservoir intake – Types of conduits – Hydraulic design of pressure pipes – Materials for pipes – Pipe joints – Laying and testing of pipes.

Unit 3 Water Treatment **10**

Layout and general outline of water treatment units – Principles and design of plain sedimentation and coagulation tanks – Working and design of slow sand filters, rapid sand filters and pressure filters – Different methods of disinfections – Chlorination practices – Breakpoint chlorination – Aeration – Softening.

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Unit 4 Distribution System **12**

Water supply systems – Layouts of distribution system – Analysis of water distribution system - simple and complex networks – Mass curve application to calculate the storage capacity of the distribution reservoir – Different types of valves and fire hydrants.

Unit 5 Air and Noise Pollution **13**

Air Pollution: Types of pollutants, sources and impacts – Air pollution control – Air quality standards – Air quality index and limits.

Noise Pollution: Impacts of noise – Permissible limits– Measurement of noise and control.

Prescribed Textbooks:

1. Water Supply & Sanitary Engineering – G. S. Birdie & J. S. Birdie, Publisher: Dhanpat Rai Publishing Company

Reference Books:

1. Environmental Engineering-I by SK Garg, Khanna Publications.
2. Environmental Engineering — H. S. Peavy, D. R. Rowe & G. Tchobanoglous Publisher: McGraw Hill Education
3. Wastewater Engineering: Treatment and Resource Recovery — Metcalf & Eddy / George Tchobanoglous et al. Publisher: McGraw-Hill Education Edition: 5th Edition (2014)
4. Manual on Water Supply & Treatment — CPHEEO, Ministry of Urban Development, Govt. of India Practical guidelines on design, standards & processes.

CO-PO Mapping:

Course Outcomes	Engine ering	Proble m	Design /Devel	Condu ct	Engine ering	The Engine	Ethics	Individ ual and	Comm unicati	Project manag	Life- long	PSO1	PSO2
24ACIV62T.1	3	2	1	2	2	2	1	1	1	1	2	3	2
24ACIV62T.2	3	3	3	2	2	2	1	1	1	1	2	3	2
24ACIV62T.3	3	3	3	2	2	2	1	1	1	2	2	3	2
24ACIV62T.4	3	3	3	2	2	2	1	1	1	2	2	3	2
24ACIV62T.5	3	3	2	3	2	3	1	1	1	1	2	3	2

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **Water Resources Engineering-I**

Category : PC

Year : III

Semester : II

Course Code : 24ACIV63T

Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To understand the fundamentals of hydrology and precipitation processes, including measurement and analysis of rainfall data.
2. To evaluate different abstractions from precipitation such as evaporation, infiltration, and to measure and analyze streamflow.
3. To analyze runoff characteristics and hydrographs and apply unit hydrograph theory for watershed response studies.
4. To estimate design floods and perform flood routing using hydrologic and hydraulic methods.
5. To understand irrigation practices and determine crop water requirements, including irrigation methods, duty, and efficiencies.

Course Outcomes:

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

1. Understand the various processes of hydrologic cycle, measurement of rainfall and analyze the rainfall data.
2. Estimate and measure Evaporation, Infiltration and Stream flow.
3. Analyze rainfall and runoff pattern and estimate the runoff by applying the concept of hydrograph and Unit hydrograph.
4. Understand the concept of flood routing and estimate the design flood.
5. Understand the types and methods of irrigation and water requirement of crops.

Unit 1 Hydrology & Precipitation **10**

Hydrology: Scope and definition – Hydrologic cycle – Water-budget equation – Practical applications. Hydrometeorology: Formation of precipitation – Types and forms of precipitation – Weather – Seasons in India – Meteorological observations.

Precipitation: Measurement – Recording and non-recording type of rain gauges – Analysis and interpretation of rain fall data – Mass curve of rain fall – Hyetograph – IDF curves – Average depth of precipitation – Double mass curve – Missing records – Network of rain gauges.

Unit 2 Evaporation and Transpiration, Infiltration, Stream flow **12**

Abstractions from Precipitation: Evaporation and evapotranspiration: Process – Factors affecting – Estimation and measurement – Reduction of evaporation – Transpiration – Evapotranspiration.

Infiltration: Definition – Factors affecting – Infiltration equations and indices – Measurement.

Stream flow: Discharge measurement – Area velocity method – Moving boat method – Stage – discharge relations.

Unit 3 Runoff & Hydrograph Analysis **14**

Runoff: Components – Factors affecting – Rain fall – Runoff relationships – Flow mass curve. Hydrograph Analysis: Features of hydrograph – Separation of base flow – Unit hydrograph (UH theory – Derivation – UH from complex storms – UH for various durations) – S-Curve hydrograph – Use and application of Unit Hydrograph.

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Unit 4 Design Flood & Flood Routing **13**

Design Flood: Introduction – Estimation of design flood – Rational Method – Flood frequency analysis. Flood Routing: Introduction – Basics of hydrologic & hydraulic modelling – Reservoir Routing – Channel Routing.

Unit 5 Irrigation & Water Requirement **10**

Definition of irrigation – Necessity – Scope – Benefits – Ill-effects – Types. Methods of Irrigation- Surface irrigation – Subsurface irrigation – Sprinkler irrigation – Drip irrigation. Water Requirements of Crops: Functions of irrigation water – Depth and frequency of irrigation – Definitions – Duty, Delta, Base period and their relation – Factors affecting duty – Methods of improving duty – Consumptive use of water – Irrigation efficiencies -Crop rotation.

Prescribed Textbooks:

1. Irrigation and Water Power Engineering By Punmia & Lal, Laxmi Publications Pvt.Ltd., New Delhi 17th Edition 2021

Reference Books:

1. Irrigation Engineering and Hydraulic Structures By S. K. Garg; Khanna Publishers,Delhi 36th Edition
2. Engineering Hydrology By Jayarami Reddy, Laxmi Publications Pvt. Ltd., New Delhi 3rd Edition 2016

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of	Conduct investigatio	Engineering Tool Usage	The Engineer	Ethics	Individual and Collaborativ	Communication	Project managemen	Life-long learning	PSO1	PSO2
24ACIV63T.1	**3**	**2**	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**1**	**1**	3	2
24ACIV63T.2	**3**	**3**	**2**	**2**	**2**	**2**	**1**	2	1	1	**2**	3	2
24ACIV63T.3	**3**	3	**2**	**2**	**2**	**2**	**1**	2	1	**1**	**2**	3	2
24ACIV63T.4	**3**	**3**	**3**	2	**2**	**2**	**1**	2	1	**1**	**1**	3	3
24ACIV63T.5	**3**	**3**	**3**	2	**2**	**2**	**1**	2	1	**1**	**2**	3	3

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ANNAMACHARYA UNIVERSITY

EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

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Rajampet, Kadapa District, A.P – 516126, INDIA

DEPARTMENT OF CIVIL ENGINEERING

Title of the Course : **Bridge Engineering**
Category : PE
Year : III
Semester : II
Course Code : 24ACIV6AT
Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To understand bridge loading standards and apply design principles for box culverts and bridge bearings under prescribed loads.
2. To analyze and design a simply supported RCC deck slab bridge using the effective width method for Class AA tracked vehicle loading.
3. To analyze and design a T-beam bridge using Pigeaud's method for load distribution under Class AA tracked vehicle loading.
4. To understand and design plate girder and composite bridges, including RCC slabs over steel girders, as per standard specifications.
5. To understand the behavior, forces, and stability requirements of bridge piers and abutments along with types of bridge foundations.

Course Outcomes:

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

1. Implement standard loading specifications for bridge design followed by IRC codes and design of Box culverts
2. Learn about Analyze and perform design of RC deck slab.
3. Acquire the knowledge about Analyze and perform design of RC T-Beam Bridges
4. Analyze and perform Design of Plate Girder Bridge and Composite bridges
5. Analyze and design various piers and abutments, bearings of the bridge structures.

Unit 1 Box Culvert **13**

Introduction: Importance of site investigation in Bridge design. Highway Bridge loading standards. Impact factor. Railway Bridge loading standards (B.G. ML Bridge) various loads in bridges.

Box Culvert: General aspects. Design loads, Design of Box culvert subjected to RC class AA tracked vehicle only.

Unit 2 Deck Slab Bridge **12**

Introduction – Effective width method of Analysis Design of deck Slab Bridge (Simply supported) subjected to class AA Tracked Vehicle only.

Unit 3 T Beam Bridges **12**

General features – Design of interior panel of slab – Pigeauds method – Design of a T-beam bridge subjected to class AA tracked vehicle only.

Unit 4 Bridges **11**

Plate Girder Bridge: Introduction – elements of a plate girder and their design. Design of a Deck type welded plate girder – Bridge of single line B.G.

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DEPARTMENT OF CIVIL ENGINEERING

Introduction to Composite Bridges(Theory)

Unit 5 Piers, Abutments and Bearings 9

Piers and Abutments: General features – Bed block – Materials for piers and abutments – Types of piers – Forces acting on piers – Design of pier – Stability analysis of piers – General features of abutments – Forces acting on abutments – Stability analysis of abutments.

Bridge Bearings: General features – Types of Bearings – Design principles of steel Rocker &Roller Bearings – Design of a steel Rocker Bearing – Design of Elastomeric pad Bearing.

Prescribed Textbooks:

1. Design of Bridges by N.Krishna Raju, Oxford & IBH, Publishing Company Pvt.ltd., Delhi..

Reference Books:

1. Bridge Engineering by PonnuSwamy, TATA Mcgraw Hill Company, New Delhi
2. Design of Bridges Structure by T.R.Jagadish&M.A.Jayaram Prentice Hall of India Pvt., Delhi.
3. **IRC:5** – Standard Specifications and Code of Practice for Road Bridges (Section I – General Features of Design)
4. **IRC:6** – Loads and Stresses (Very important for design loads like IRC Class AA, A, B)
5. **IRC:70** – Loading and Design of Bridges (Limit State Design)
6. **IRC:21** – Standard Specifications for Road Bridges (Section III – Cement Concrete)
7. **IRC:112** – Code of Practice for Concrete Road Bridges (Limit State Method – MOST IMPORTANT).
8. **IS 456:2000** – Plain and Reinforced Concrete.
9. **IS 800:2007** – General Construction in Steel.

CO-PO Mapping:

Course Outcomes	Enginee ring	Problem Analysis	Design/ Develop	Conduct investig	Enginee .	The Enginee	Ethics	Individu al and	Commu .	Project manage	Life- .	PSO1	PSO2
24ACIV6AT.1	3	2	3	2	2	1	1	-	-	-	1	3	2
24ACIV6AT.2	3	3	3	2	2	1	1	-	-	-	1	3	2
24ACIV6AT.3	3	3	3	2	2	1	1	-	-	-	1	3	2
24ACIV6AT.4	3	3	3	2	2	1	1	-	-	-	1	3	3
24ACIV6AT.5	3	3	3	3	2	1	1	-	-	-	1	3	3

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course : **Foundation Engineering**
Category : PE
Year : III
Semester : II
Course Code : 24ACIV6BT
Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. Introduce the need and methods of soil exploration, boring, sampling, and field testing.
2. Understand earth slope stability concepts and analyze different modes of slope failure.
3. Explain lateral earth pressure theories and their application to retaining structures.
4. Develop ability to analyze and design shallow foundations based on bearing capacity and settlement.
5. Provide knowledge on pile and well foundations, including load capacity, settlement, and construction aspects.

Course Outcomes:

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

1. Plan and execute soil exploration programmes, select appropriate boring, sampling, and field tests, and prepare soil investigation reports.
2. Explain and apply water treatment processes such as sedimentation, coagulation, filtration, disinfection, softening, and desalination.
3. Evaluate lateral earth pressures using Rankine's and Coulomb's theories for retaining wall design.
4. Estimate the bearing capacity of shallow foundations and select foundation types based on soil conditions.
5. Design deep foundations (piles and wells) and determine their load-carrying capacity and settlement.

Unit 1 Soil Exploration **9**

Need – Methods of soil exploration – Boring and Sampling methods – Field tests – Penetration Tests – Plate load test – Pressure meter – planning of exploration Programme and preparation of soil investigation report.

Unit 2 Earth Slope Stability **11**

Infinite and finite earth slopes – types of failures – factor of safety of infinite slopes – stability analysis by Swedish circle method, standard method of slices, Bishop's Simplified method – Taylor's Stability Number- Stability of slopes of earth dams under different conditions.

Unit 3 Earth Pressure Theories **12**

Lateral earth pressure theory, Different types of earth pressures, Rankine"s active and passive earth pressures, pressure distribution diagram for lateral earth pressures against retaining walls for different conditions in cohesionless and cohesive soils, Coulomb"s earth pressure theory, Graphical techniques- Rebhann"s and Culmann"s construction.

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Unit 4 Shallow Foundations **10**

Functions and requisites - Different types of foundations - choice of foundation type - types of failures – general principles of design. Bearing capacity - Basic Definitions - Bearing capacity analysis by Terzaghi's, meyerhoff and skempton"s analysis - Bearing capacity based on settlement and building codes. Field measures – SPT, CPT and Plate load tests.

Unit 5 Pile Foundation **12**

Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae – Pile load tests – Load carrying capacity of pile groups in sands and clays – Settlement of pile groups.

Well Foundations: Types – Different shapes of wells – Components of wells – functions and Design Criteria – Sinking of wells – Tilts and shifts.

Prescribed Textbooks:

1. Soil Mechanics and Foundation Engineering by K R Arora, Standard Publishers and Distributors, Delhi

Reference Books:

1. Das, B.M., - (1999) Principles of Foundation Engineering –6th edition (Indian edition) Thomson Engineering
2. Bowles, J.E., (1988) Foundation Analysis and Design– 4thEdition, McGraw-Hill Publishing company, Newyork.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Engineering Tool	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV6BT.1	3	2	3	2	2	1	1	–	–	–	1	2	3
24ACIV6BT.2	3	3	3	2	2	1	1	–	–	–	1	3	2
24ACIV6BT.3	3	3	3	2	2	1	1	–	–	–	1	3	2
24ACIV6BT.4	3	3	3	2	2	1	1	–	–	1	1	3	3
24ACIV6BT.5	3	3	3	2	2	1	1	–	–	1	1	3	3

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **Remote Sensing and GIS**

Category : PE
Year : III
Semester : II
Course Code : 24ACIV6T
Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To understand the principles of aerial photogrammetry and modern land surveying techniques, including levelling, total station, and electronic distance measurement.
2. To comprehend the fundamentals of remote sensing, including electromagnetic spectrum, sensors, resolutions, and data interpretation methods.
3. To develop knowledge of maps and coordinate systems, including projections, datums, and their applications in engineering projects.
4. To apply GIS concepts for spatial data analysis, database creation, and solving engineering problems such as land use planning and hydrological studies.
5. To understand GNSS and drone surveying techniques for accurate data collection, error correction, and modern surveying applications.

Course Outcomes:

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

1. Understand the Photogrammetry, EDM and Total station surveying principles to solve surveying problems using appropriate tools and techniques.
2. Understand the concepts of remote sensing and interpretation methods.
3. Understand the importance of maps, concept of map projections.
4. Understand the concept of GIS and its applications, different data models, spatial analysis.
5. Understand the principles used in GNSS and Drone surveying, data collection methods, error in observations and corrections.

Unit 1 Aerial Photogrammetry and Land Survey **9**

Aerial Photogrammetry: Stereoscopy – 3-D Model – Height determination using Parallax Bar – Digital Elevation Model (DEM) – Slope.

Land Surveying: Various Levels – Levelling methods – Total Station – EDM – Working principle – Parts of Total Station – Capabilities and applications of Total Station – Traversing – Triangulation and Trilateration.

Unit 2 Remote Sensing **9**

Basic concept – Electromagnetic spectrum – Spectral signature – Resolutions – Spectral. Spatial, Temporal and Radiometric – Platforms and Sensors – Remote Sensing Data Products – PAN – Multispectral, Microwave, Thermal, Hyper spectral – Visual and digital interpretation methods.

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DEPARTMENT OF CIVIL ENGINEERING

Unit 3 Maps **9**

Importance of maps to engineering projects – Types of maps – Scales and uses – Plotting accuracy – Map sheet numbering – Coordinate systems – Cartesian and geographical, map projections, map datum – MSL, Geoid, Spheroid, WGS-84.

Unit 4 GIS and Applications **9**

GIS: Introduction – Data Sources – Data Models and Data Structures – Algorithms, DBMS – Creation of Databases (spatial and non-spatial) – Spatial analysis – Interpolation – Buffer, Overlay – Terrain Modelling and Network analysis.

Applications: Land use / Land cover classification – Rainfall runoff studies – Flood and drought impact assessment and monitoring – Regional and urban 160 planning and management – GIS based highway alignment.

Unit 5 GNSS and Drone Surveying **9**

GNSS: Principle used – Components of GNSS – Data collection methods – DGPS – Errors in observations and corrections.

Drone Surveying: Working principle – Benefits of drones in surveying – Applications – Interior and exterior drone surveying – Calculation of length, area and stockpile volume.

Prescribed Textbooks:

1. Textbook of Remote Sensing and GIS, M. Anji Reddy, 4th edition, BS Publications.

Reference Books:

1. Concepts and Techniques of Geographic Information Systems Prentice Hall , Lo, C.P. and Yeung, Albert K.W., , 2002.
2. Fundamentals of Geographic Information Systems, Michael N. Demers, Wiley,2009

CO-PO Mapping:

Course Outcomes	Engineer…	Problem…	Design/D…	Conduct inv…	Engineer… T…	The…	Ethics	Individua l and	Commun…	Project	Life-long learning	PSO1	PSO2
24ACIV7FT.1	3	2	–	–	–	2	–	–	–	–	2	2	2
24ACIV7FT.2	3	2	1	–	–	2	1	–	–	–	2	3	3
24ACIV7FT.3	2	3	–	2	2	–	–	–	–	–	2	3	3
24ACIV7FT.4	3	3	2	1	2	2	-	–	–	1	2	2	3
24ACIV7FT.5	2	2	1	2	3	1	1	–	–	1	2	2	3

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Rajampet, Kadapa District, A.P – 516126, INDIA

DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **Analysis and Design of structures Laboratory-II (E-Tabs)**

Category : PC
Year : III
Semester : II
Course Code : 24ACIV61L
Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

1. familiarize students with ETABS software as a professional tool for structural modeling, analysis, and design.
2. To enable students to model and analyze 2D and 3D structural systems such as beams, trusses, frames, and buildings using ETABS.
3. To develop skills to analyze and design RC and steel structures under various loading conditions including earthquake loads.
4. To impart practical knowledge on multi-storied building analysis and design using appropriate design codes.
5. To train students in member grouping and design grouping techniques, including integration with SAFE for foundation analysis.

Course Outcomes:

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

1. Outline the importance of ETABS in Analyzing the structures
2. Learn the tools useful for modeling, analyzing, designing a structure
3. Analyse & Design a Building for different loading conditions coming on to the structures
4. Analyse & Design of Multi storied Building
5. Gain the knowledge Design Grouping in Steel structures

List of Experiments: -

1. Basics of Structures and about the ETABS
2. Introduction to various commands of ETABS and their applications in detail.
3. 2D model, analysis and design for different types of Trusses.
4. 2D model, analysis and design for different types of Beams.
5. 2D model, analysis and design for Frames.
6. 3D model, analysis and design for Frames.
7. 3D model and analysis& Design for RC Buildings.
8. 3D model and analysis& Design for Steel.
9. Earthquake load application to RC and steel structures along with the design.
10. Design & analysis of Multi storied Building.
11. Members grouping
12. Design Grouping in Steel structures

Note- 10 Experiments out of 12 should be conducted mandatorily

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DEPARTMENT OF CIVIL ENGINEERING

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV61L.1	2	1	–	–	3	–	–	–	–	–	2	2	3
24ACIV61L.2	2	2	2	–	3	–	–	–	–	–	2	2	3
24ACIV61L.3	3	3	3	1	3	–	1	–	–	1	2	3	3
24ACIV61L.4	3	3	3	1	3	–	1	–	–	1	2	3	3
24ACIV61L.5	3	2	3	–	3	–	1	–	–	–	2	2	3

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Rajampet, Kadapa District, A.P – 516126, INDIA

DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **Environmental Engineering Laboratory**

Category : PC
Year : III
Semester : II
Course Code : 24ACIV62L
Branch/es : Civil Engg

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

1. Provide practical training in sampling and preservation techniques for water and wastewater analysis
2. Enable measurement of physical and chemical water quality parameters using standard laboratory methods
3. Develop skills to analyze key wastewater quality indicators such as BOD, COD, and TKN
4. Train students to evaluate the performance and efficiency of water treatment processes through lab tests
5. Impart hands-on experience in microbiological analysis and sludge characterization for environmental assessment

Course Outcomes:

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

1. Apply appropriate sampling and preservation techniques for water and wastewater.
2. Measure physical and chemical parameters such as turbidity, conductivity, and chlorine content.
3. Analyze key water and wastewater quality indicators like BOD, COD, and TKN.
4. Assess the efficiency of water treatment processes through laboratory tests.
5. Perform microbiological analysis for coli form detection and sludge characterization.

LIST OF EXPERIEMENTS: -

I. ANALYSIS of WATER SAMPLE

1. Measurement of Electrical conductivity and turbidity Determination of Optimum Coagulant Dosage by Jar test apparatus.
2. Determination of available Chlorine in Bleaching powder and residual chlorine in water.
3. Determination of acidity in water
4. Determination of alkalinity in water
5. Determination of Hardness in water
6. Determination of Chlorides in water
7. Estimation of suspended, volatile and fixed solids
8. Determination of Dissolved Oxygen
9. Estimation of B.O.D.
10. Estimation of C.O.D(Demo)
11. Determination of Sludge Volume Index by Imhoff Cone

Note- 10 Experiments out of 11 should be conducted mandatorily

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DEPARTMENT OF CIVIL ENGINEERING

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV62L.1	3	1	–	3	2	–	–	1	1	-	2	2	2
24ACIV62L.2	3	2	-	3	3	–	–	1	1	-	2	2	2
24ACIV62L.3	3	2	-	3	3	–	–	1	1	-	2	3	2
24ACIV62L.4	3	3	1	3	2	1	-	1	1	-	2	3	2
24ACIV62L.5	3	3	-	3	2	1	-	1	1	-	2	3	2

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DEPARTMENT OF CIVIL ENGINEERING

Title of the Course: **AI-Assisted Building Planning and Estimation Laboratory**

Category : PC
Year : III
Semester : II
Course Code : 24ACIV64L
Branch/es : CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

1. To develop skills in prompt engineering for building planning tasks.
2. To apply AI tools for quantity take-off and estimation.
3. To generate BOQ and cost estimates using AI assistance.
4. To validate AI-generated outputs with conventional methods.
5. To prepare a complete AI-assisted planning and estimation report.

Course Outcomes:

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

1. Develop effective prompts for building planning tasks using AI tools.
2. Generate AI-assisted quantity take-off and BOQ.
3. Prepare detailed cost estimates using AI-based support.
4. Analyze and validate AI-generated estimation outputs.
5. Prepare a complete AI-assisted building planning and estimation report.

List of Experiments: -

1. Introduction to AI tools and prompt engineering basics for civil engineering applications.
2. Drafting effective prompts for residential building planning requirements (plot size, setbacks, number of rooms, etc.).
3. AI-assisted preparation of conceptual building layout description and space planning.
4. Generating quantity take-off (earthwork, concrete, brickwork, plastering) using AI prompts.
5. Preparation of Bill of Quantities (BOQ) using AI-generated data and Excel.
6. AI-assisted rate analysis for selected building components.
7. Preparation of detailed cost estimate for a small residential building using AI.
8. Comparison of manual estimation vs AI-assisted estimation (error analysis and accuracy check).
9. AI-assisted preparation of project schedule (basic Gantt chart).
10. **(Mini Project):**Complete AI-assisted building planning and estimation for a G+1 residential building including:

- Planning description
- Quantity take-off
- BOQ
- Detailed estimate
- Basic project schedule
- Report submission

Note- 9 Experiments out of 10 should be conducted mandatorily

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DEPARTMENT OF CIVIL ENGINEERING

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACIV55L.1	2	2	2	–	3	1	–	–	1	–	2	2	2
24ACIV55L.2	3	2	2	2	3	–	–	1	1	–	2	2	2
24ACIV55L.3	3	2	3	2	3	–	–	1	–	–	3	2	3
24ACIV55L.4	3	2	3	3	3	1	–	1	–	–	2	2	3
24ACIV55L.5	3	1	2	3	3	2	1	1	1	1	3	2	3

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