BOARD OF STUDIES MEETING – 2018-19

K.S.R.M COLLEGE OF ENGINEERING

AUTONOMOUS

Minutes of the Meeting

Date	**08.06.2018**	**Day**	**Friday**
Time	**10:30 AM**	**Venue**	**Seminar hall, Civil Engineering Dept.**
Dept./SS	**Civil Engineering**	**Convener**	**Dr. G. Sreenivasa Reddy**

Members Present: 10

S.No	Name	Designation	Signature
1.	Prof. D. Rama Sheshu	Prof. of CE, NIT Warangal	
2.	Prof. J. V. Gurumurthy	Prof. of CE, GPRCE	
3.	Prof. G. Sreenivasulu	Prof. of CE, RGM-Nandyal	
4.	Sri. M. Konda Reddy	Executive Engineer, Irrigation Dept. Kadapa.	
5.	Prof. G. Sreenivasa Reddy	Prof., KSRMCE	
6.	Prof. T. Kiran Kumar	Prof., KSRMCE	
7.	Prof. V. Giridhar	Prof., KSRMCE	
8.	Sri. P. Suresh Praveen Kumar	Assistant Prof., KSRMCE	
9.	Sri. N. Prathap Kumar	Assistant Prof., KSRMCE	
10.	Sri. P. Rajendra Kumar	Assistant Prof., KSRMCE	

Members Absent: 01

S.No	Name	Designation
1	Sri. N. Siva Prasad Reddy	Principal, Brundavan Engg. College, Kurnool

Dr. G. Sreenivasa Reddy, welcomed all the members to the meeting and presented the agenda of the meeting.

The resolutions are:

	To do item	Discussion	Resolution	Coordinator/in-charge
1	To finalize the 7th & 8th semesters Syllabus of R-15-UG regulations.	The Head of the Department has presented the syllabus designed by the faculty of CE by considering the stakeholders feedback & action taken report and by comparing with premier institutes curriculum.	The committee accepted the proposed 7th & 8th semesters syllabus of R-15-UG regulations with minor corrections.	Dr. G. Sreenivasa Reddy
2	The finalize curriculum of 1st, 2nd, 3rd & 4th semesters R18-PG regulations.	The Head of the Department has presented the syllabus designed by the faculty of CE by considering the stakeholders feedback & action taken report and by comparing with premier institutes curriculum.	The committee accepted the curriculum and syllabus of 18-PG regulations (1st, 2nd, 3rd & 4th semesters).	Sri. P. Suresh Praveen Kumar
3	To finalize the curriculum and syllabus of 1st & 2nd semesters, R-18-UG regulations.	The Head of the Department has presented the syllabus designed by the faculty of CE by considering the stakeholders feedback & action taken report and by comparing with premier institutes curriculum.	The committee accepted the curriculum and syllabus of 1st & 2nd semesters, R-18-UG regulations. The committee also suggested to bring the practical exposer to the students by arranging the interactions with industry exports at earlier stages of the program.	Prof. T. Kiran Kumar
4	To finalize and approve the syllabus for New Courses, Value Added Courses, Certificate Courses, Skill Courses, Employability Courses and Entrepreneurship Courses..	The Head of the Department has presented the syllabus designed by the faculty of CE by considering the stakeholders feedback & action taken report and by comparing with premier institutes curriculum.	The committee approved the content for offering New Courses, Value Added Courses, Certificate Courses, Skill Courses, Employability Courses and Entrepreneurship Courses to implement in 2018-19.	Prof. V. Giridhar

The Head of the Department have proposed the Vote of thanks and Concluded the meeting.

Convenor

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Regulations for UG Program in Engineering (R15 UG)

(Effective from 2015-16 for regular students and 2016-17 for lateral entry students)

B. Tech (R15) Syllabus
Civil Engineering

Kandula Srinivasa Reddy Memorial College of Engineering (Autonomous)

Kadapa-516005. AP

(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC)

(An ISO 9001-2008 Certified Institution)

UG Programs in Civil Engineering (R15UG)

Curriculum

1st Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521101	BS	Mathematics – 1	3	1	0	30	70	3
1522102	BS	Engineering Physics	3	1	0	30	70	3
1523103	BS	Engineering Chemistry	3	1	0	30	70	3
1524104	HS	English – 1	4	0	0	30	70	3
1503105	ED	Engineering Drawing – 1	1	0	3	30	70	3
1525106	HS	Human Values and Professional Ethics	4	0	0	30	70	3
1599107	BS	Physics and Chemistry Laboratory	0	0	3	50	50	2
1524108	HS	English Language & Communication Skills Lab	0	0	3	50	50	2
		Total	**18**	**3**	**9**	**280**	**520**	**22**

2nd Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521201	BS	Mathematics – 2	3	1	0	30	70	3
1521202	BS	Mathematics – 3	3	1	0	30	70	3
1505203	ED	Programming in C	3	1	0	30	70	3
1524204	HS	English – 2	4	0	0	30	70	3
1503205	ED	Engineering Drawing – 2	1	0	3	30	70	3
1501206	HS	Environmental Studies	4	0	0	30	70	3
1599207	ED	Engineering Workshop	0	0	3	50	50	2
1505208	ED	Programming in C Laboratory	0	0	3	50	50	2
		Total	**18**	**3**	**9**	**280**	**520**	**22**

3rd Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521302	BS	Probability and Statistics	3	1	0	30	70	3
1501301	ED	Engineering Mechanics	3	1	0	30	70	3
1501303	PJ	Surveying – 1	3	1	0	30	70	3
1501304	PJ	Building Materials	3	1	0	30	70	3
1501305	PJ	Fluid Mechanics	3	1	0	30	70	3
1501306	PJ	Engineering Geology	3	1	0	30	70	3
1501307	PJ	Surveying Field Work – 1	0	0	3	50	50	2
1501308	PJ	Engineering Geology Laboratory	0	0	3	50	50	2
		Total	**18**	**6**	**6**	**280**	**520**	**22**

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4th Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502401	PN	Basic Electrical & Electronics Engineering	3	1	0	30	70	3
1501402	PJ	Mechanics of Materials – 1	3	1	0	30	70	3
1501403	PJ	Surveying – 2	3	1	0	30	70	3
1501404	PJ	Building Construction	3	1	0	30	70	3
1501405	PJ	Hydraulic Machinery	3	1	0	30	70	3
1501406	PJ	Geo-Technical Engineering – 1	3	1	0	30	70	3
1501407	PJ	Surveying Field Work – 2	0	0	3	50	50	2
1501408	PJ	Fluid Mechanics & Hydraulic Machinery Lab	0	0	3	50	50	2
1501409	PN	Basic Electrical and Electronics Engineering Lab	0	0	3	-	-	-
		Total	**18**	**6**	**9**	**280**	**520**	**22**

5th Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1501501	PJ	Mechanics of Materials - 2	3	1	0	30	70	3
1501502	PJ	Geo-Technical Engineering - 2	3	1	0	30	70	3
1501503	PJ	Hydrology	3	1	0	30	70	3
1501504	PJ	Concrete Technology	3	1	0	30	70	3
1501505	PJ	Water Supply Engineering	3	1	0	30	70	3
1501506 1501507 1501508	PN	**Elective – 1 (Non-Core)** Introduction to Java Programming Operation Research Entrepreneurship	3	1	0	30	70	3
1501509	PJ	Strength of Materials Laboratory	0	0	3	50	50	2
1501510	PJ	Geo-Technical Engineering Laboratory	0	0	3	50	50	2
		Total	**18**	**6**	**6**	**280**	**520**	**22**

6th Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1525601	HS	Managerial Economics & Financial Analysis	3	1	0	30	70	3
1501602	PJ	Structural Analysis – 1	3	1	0	30	70	3
1501603	PJ	Design & Detailing of Reinforced Concrete Structures – 1	3	1	0	30	70	3
1501604	PJ	Water Resources Engineering – 1	3	1	0	30	70	3
1501605	PJ	Transportation Engineering - 1	3	1	0	30	70	3
1501606 1501607 1501608	PN	**Elective – 2 (Core)** Remote Sensing and GIS Watershed and River Basin Management	3	1	0	30	70	3

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		Civil Engineering Professional Practice						
1501609	PJ	Environmental Engineering Laboratory	0	0	3	50	50	2
1501610	PJ	Computer Aided Building Drawing Lab	0	0	3	50	50	2
		Total	**18**	**6**	**6**	**280**	**520**	**22**

7th Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1501701	PJ	Structural Analysis – 2	3	1	0	30	70	3
1501702	PJ	Design & Detailing of Reinforced Concrete Structures – 2	3	1	0	30	70	3
1501703	PJ	Design & Detailing of Steel Structures	3	1	0	30	70	3
1501704	PJ	Transportation Engineering - 2	3	1	0	30	70	3
1501705	PJ	Water Resources Engineering – 2	3	1	0	30	70	3
1501706 1501707 1501708	PJ	**Elective – 3 (Core)** Pre-stressed Concrete Advanced Foundation Engineering Construction Planning & Management	3	1	0	30	70	3
1501709	PJ	Concrete & Highway Materials Laboratory	0	0	3	50	50	2
1501710	PJ	CADD Lab	0	0	3	50	50	2
		Total	**18**	**6**	**6**	**280**	**520**	**22**

8th Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1501801	PJ	Sanitary Engineering	3	1	0	30	70	3
1501802	PJ	Design & Drawing of Irrigation Structures	3	1	0	30	70	3
1501803	PJ	Quantity Surveying and Valuation	3	1	0	30	70	3
1501804 1501805 1501806	PJ	**Elective – 4 (Core)** Finite Element Method Environmental Impact Assessment Bridge Engineering	3	1	0	30	70	3
1501807	PJ	Seminar	0	0	3	50	50	44
1501808	PJ	Project Work	0	0	10	50	50	10
		Total	**12**	**4**	**13**	**220**	**380**	**26**

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VII Semester
Syllabus

B. Tech., VII Semester

Course Title	Structural Analysis – 2				B. Tech. VII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1501701	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

Course Objective:

- To understand application of Castigliano's theorem 1and 2 for beams and trusses
- To study the behavior of arches and their methods of analysis
- To have basic knowledge of I.L for reaction, bending moment and shear force in simply supported beam.
- To learn and analyze continuous beams by flexibility and stiffness method
- To understand the methods of analysis of indeterminate trusses for external loads, lack of fit and thermal effect.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Differentiate Determinate and Indeterminate Structures
CO 2	Analyze the arches with different end conditions
CO 3	Draw the influence lines and construct the ILD diagram for the moving loads.
CO 4	Analyze the loads in Pratt and Warren trusses, design of bridge structures
CO 5	Use the concepts of matrix method for analysis of beams, frames and trusses.

UNIT-I

Indeterminate Structural Analysis: Indeterminate Structural Analysis – Determination of Static and Kinematic Indeterminacies – Solution of Trusses with up to Two Degrees of Internal and External Indeterminacies – Castiglioni's Theorem.

UNIT - II

Arches:

Three Hinged Arches: Elastic Theory of Arches – Eddy's Theorem – Determination of Horizontal Thrust – Bending Moment – Normal Thrust and Radial Shear – Effect of Temperature.

Two Hinged Arches: Determination of Horizontal Thrust Bending Moment – Normal Thrust and Radial Shear – Rib Shortening and Temperature Stresses – Tied Arches – Fixed Arches – (No Analytical Question).

UNIT - III

Moving Loads: Introduction – Maximum SF and BM at a Given Section and Absolute Maximum S.F. and B.M Due to Single Concentrated Load U. D Load Longer than the Span – U. D Load Shorter than the Span – Two-Point Loads with Fixed Distance between them and Several Point Loads – Equivalent Uniformly Distributed Load – Focal Length.

UNIT - IV

Influence Lines: Definition of Influence Line for SF – Influence Line for BM – Load Position for Maximum SF at a Section – Load Position for Maximum BM at a Section Point Loads – U.D. Load Longer than the Span – U.D. Load Shorter than the Span – Influence Lines for Forces in Members of Pratt and Warren Trusses.

UNIT - V

Flexibility and Stiffness Methods:

Flexibility Method: Introduction – Application to Continuous Beams Including Support Settlements.

Stiffness Method: Introduction to Stiffness Method and its Application to Continuous Beams including Support Settlements.

Text Books:

1. Dr. C S Reddy "Structural Analysis", Tata McGraw-Hill Companies, Inc. New York.
2. S Ramamrutham and R Narayan "Theory of Structures", Dhanpat Rai Publishing Company (P) Limited, New Delhi.
3. Theory of Structures by B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications, 12th Edition.
4. Theory of Structures – Vol. II by S.P.Gupta, G.S. Pandit, R.Gupta, Tata McGraw-Hill Publishers, Ist Edition.

Reference Books:

1. Devdas Menon "Structural Analysis", Narosa Publishing House, New Delhi.
2. V N Vazirani, M M Ratwani and S K Duggal "Analysis of Structures", Khanna Publishers, New Delhi.
3. S S Bhavikatti "Structural Analysis – 1 & 2", Vikas Publishing House Pvt. Limited, New Delhi.
4. G S Pandit and S P Gupta "Structural Analysis – A Matrix Approach", Tata McGraw-Hill Companies, Inc. New York.

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B. Tech., VII Semester

Course Title	Design and Detailing of Reinforced Concrete Structures – 2				B. Tech. VII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1501702	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs		

Course Objective:

- The primary objective of the course is to extend student's knowledge and proficiency in reinforced concrete structural design, analysis, and special detailing.
- Structural member modelling and analysis will be emphasized by developing small computer programs and/or by using available computer software.
- Structural member and system design will be implemented using the current code standards and specifications.
- To enable the student design more complex structural elements of reinforced concrete and model their behaviour using computer applications.
- Students will build on their knowledge of basic reinforced concrete design and learn to:
  - ✓ Model and predict the response of reinforced concrete members under axial, flexure and shear loads, and
  - ✓ Design typical reinforced concrete components such as beams, slabs, footings, retaining walls, slender columns and pre-stressed beams

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Distinguish the different types of slabs
CO 2	Design of columns following IS code specifications
CO 3	Design footings
CO 4	Design of cantilever retaining walls
CO 5	Design of water storage tanks

UNIT- I

Design of Slabs: Design of One Way Continuous Slab – Design of T-Beam Roof Slab Simply Supported on Four Edges, With Corners Not Held Down and Carrying U.D.L – Slab Simply Supported on the Four Edges With Corners Held Down and Carrying U.D.L. – Indian Standard Code Method – Design of Continuous Slabs – Design of Circular Slabs.

UNIT - II

Design of Slender Column: Behaviour of Slender Columns – Braced and Unbraced Slender Columns – Second Order Structural Analysis of Slender Column Structures – IS Code Provisions for Slender Columns – Strength Reduction Coefficient Method – Additional Moment Method – Design of Columns with Axial Tension and Uniaxial Bending.

UNIT - III

Design of Footings:

Isolated Footings: Allowable Soil Pressure – Distribution of Base Pressure – Concentrically Loaded Footings – Eccentrically Loaded Footings – Overturning and Sliding – General Design Considerations and Code Requirements – Design of Plain Concrete Footing – Design of Rectangular Reinforced Concrete Footing.

Combined Footings: Distribution of Soil Pressure – Geometry of Two-Column Combined Footings – Design Considerations in Two-Column Footings – Design of Two-Column Combined Footings: Rectangular and Trapezoidal Footings.

UNIT - IV

Design of Cantilever Retaining Walls: Types of Retaining Walls – Behaviour – Lateral Earth Pressure – Effect of Surcharge – Effect of Water Table – Proportioning Cantilever Retaining Walls – Stability Requirements – Soil Bearing Pressure Requirement – Design of Cantilever Retaining Wall with Horizontal and Inclined Backfill.

UNIT – V

Design of Water Storage Tanks: Analysis Using IS-3370 – Underground and Over the Ground Supported Tanks – Design of Rectangular and Circular Water Tanks with Flexible and Rigid Joints between Floor and Wall.

Text Books:

1. N. Subramanian "Design of Reinforced Concrete Structures", Oxford University Press, New Delhi.
2. P.C. Varghese "Advanced Reinforced Concrete Design", Prentice-Hall of India private Limited, New Delhi.
3. Reinforced concrete design by S.Unnikrishna Pillai & Devdas Menon, Tata Mc.Graw Hill, New Delhi
4. Limit State Design by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi

Reference Books:

1. M L Gambhir "Fundamentals of Reinforced Concrete Design", PHI Learning Pvt. Limited, New Delhi.
2. P C Varghese "Limit State Design of Reinforced Concrete", PHI Learning Pvt. Limited, New Delhi.
3. Reinforced concrete structural elements – behaviour, Analysis and design by P.Purushotham, Tata Mc.Graw-Hill, 1994I
4. S 3370-2009 "Indian Standard Code of Concrete Structures for Storage of Liquids – Code of Practice", Bureau of Indian Standards, New Delhi.

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B. Tech., VII Semester

Course Title	Design and Detailing of Steel Structures				B. Tech. VII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1501703	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

Course Objective:

- Steel structures and structural elements are analyzed and designed by elastic & plastic methods. These methods based on experimental investigations. The structural design in a limited sense also deals with the design of various parts or members of structures.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Design the different types of structural steel sections.
CO 2	Design different types of compression and tension members which are used in different types of steel constructions.
CO 3	Able to differentiate and design different types of Beams, column bases and welded connections

UNIT- I

Plastic Analysis and Welded Connections:

Plastic Analysis: Introduction – Idealized Stress – Strain Diagram – Shape Factors for Various Sections – Moment Curvature Relationship – Ultimate Moment – Plastic Hinge – Lower and Upper Bound Theorems – Ultimate Strength Fixed and Continuous Beams – Frames.

Welded Connections: Introduction – Advantages and Disadvantages of Welding – Strength of Welds – Butt and Fillet Welds – Permissible Stresses – IS Code Requirements – Design of Welds Subjected to Moment Acting in the Plane and at Right Angles to the Plane of the Joints – Beam to Beam and Beam to Column Connections.

UNIT - II

Design of Tension and Compression Members:

Tension Members: Types of Sections – Net Effective Section for Angles and Tees in Tensions – Lug Angles – Tension Splices

Compression Members: Plain and Built Up Compression Members – Assumptions Regarding End Conditions – Design of Built Up Columns with Battens and Lacings – Splicing of Column.

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UNIT - III

Beams: Allowable Stresses – Design Requirements as per IS Code – Design of Simple and Compound Beams- Curtailment of Flange Plates – Beam to Beam Connections – Check for Deflections – Shear – Buckling – Check for Bearing – Laterally Unsupported Beams

UNIT - IV

Design of Beam to Column Connections: Introduction – Design of Beam to Column Connections – Framed, Stiffened, Un-Stiffened and Seated Bracket Connections.

UNIT - V

Design of Column Bases: Design of Slab Base and Gusseted Bases – Column Bases subjected to Moment.

Text Books:

1. S K Duggal "Limit State Design of Steel Structures", Tata McGraw-Hill Companies, Inc. New York.
2. S S Bhavikatti "Design of Steel Structures", I K International Publishing House Pvt. Limited, New Delhi.
3. Design of steel structures by M Raghupathi Tata MC Graw –Hill
4. Steel structures by Subramanian N, Oxford Higher Education, New Delhi

Reference Books / Is Codes / Tables:

1. IS 800 – 2007 "Indian Standard Code of Practice for General Construction in Steel", Bureau of Indian Standards, New Delhi.
2. IS 875 – Part – 3 "Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Building and Structures – Wind Loads", Bureau of Indian Standards, New Delhi.
3. K L V Ramu and Subhash Chander "Steel Tables – SI Units", Jain Brothers, New Delhi.
4. Limit state Design of steel structures by S.K. Duggal Tata MCgraw Hill, New Delhi

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B. Tech., VII Semester

Course Title	Transportation Engineering – 2				B. Tech. VII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1501704	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

Course Objective:

- To understand the various components of railway Engineering.
- To know various component involved in the track design concept of railway Engineering.
- To understand the techniques involved in harbour Layout.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	List the components of railway Engineering and their functions.
CO 2	Design railway track geometrics.
CO 3	List the requirement of airport site selection
CO 4	List the requirement of a harbour
CO 5	List suitable harbour maintenance methods.

UNIT- I

Introduction to Railway Engineering: Permanent Way Components – Cross Section of Permanent Way – Functions of Various Components Like Rails, Sleepers and Ballast – Rail Fastenings – Creep of Rails – Theories Related to Creep – Adzing of Sleepers Sleeper Density – Geometric Design of Rail Way Track – Gradients –Grade Compensation – Degree of Curve Cant and Negative Super Elevation – Cant Deficiency.

UNIT – II

Geometric Design of Railway Track: Gradients – Grade Compensation – Cant and Negative Super Elevation – Cant Deficiency – Degree of Curve Crossings and Turn Outs – Stations and Yards – Introduction – Purposes of Rail Way Stations – Selection of a Site for a Railway Station – Types of Railway Stations – Definition of a Yard – Types of Yards – Tunnelling Definition – Types of Tunnelling – Drainage in Tunnels –Ventilation of Tunnels – Lining of Tunnels – Underground Railways – Tube Railways – Maintenance of Railway Tunnels.

UNIT - III

Airport Engineering: Airport Site Selection – Factors affecting Site Selection and Surveys – Runway Orientation – Wind Rose Diagram – Basic Runway Length – Correction for Runway Length – Terminal Area – Layout and Functions – Concepts of Terminal Buildings – Simple Building, Linear Concept, Pier Concept and Satellite Concept – Typical Layouts – Runway and Taxiway Lighting.

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UNIT - IV

Harbours, Docks and Break Water: Introduction – Natural Harbours – Artificial Harbours – Size of Harbours – Open Berths – Docks – Shape of Docks and Basins – Design and Construction of Basin or Dock Walls – Dock Entrances and Entrance Locks Classification of Breakwaters – Upright Wall Breakwater – Mound with Super Structure Water Breaker – Mound Breakwaters.

UNIT - V

Dredging and Maintenance: Introduction – Types of Dredgers – Bucket or Ladder Dredger – Sand Pump or Hydraulic Dredger or Cutter Dredger – Grab Dredger – Rock Dredger – Dipper Dredger – Hopper Barge –Maintenance of Buildings – Protection of Timber Piles – Maintenance of Lock Gates and Caissons – Maintenance Fresh Water – Hydraulic and Electric Mains – Soundings – Organization of Maintenance.

Text Books:

1. S C Saxena and S P Arora "A Text Book of Railway Engineering", Dhanpat Rai Publishing Company (P) Limited, New Delhi.
2. V N Vazirani and S P Chandola "Transportation Engineering – Vol-2", Khanna Publishers, New Delhi..
3. Transportation Engineering, Railways, Airports, Docks & Harbours, Srinivasa Kumar R, University Press, Hyderabad
4. Transportation Engineering Planning Design, Wright P. H. & Ashfort N. J., John Wiley & Sons

Reference Books:

1. Satish Chandra and M M Agarwal "Railway Engineering", Oxford & IBH Publishing Company (P) Limited, New Delhi.
2. R Srinivasan "Harbour, Dock and Tunnel Engineering", Charotar Publishing House Pvt. Limited, Anand.
3. Hasmukh P Oza and Gautam Oza "Dock and Harbour Engineering", Charotar Publishing House Pvt. Limited, Anand.
4. Airport Engineering, Virendra Kumar, Dhanpat Rai Publishers, New Delhi.

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B. Tech., VII Semester

Course Title	Water Resources Engineering – 2				B. Tech. VII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1501705	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Objective:

- To study the various factors considering for construction of different head works i.e., canal head works, cross drainage works etc.,
- To study the different components and their applications
- To study the various design procedures and their engineering significances
- To study the different tools required for knowing performance of water resources projects.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Distinguish of irrigation systems, various water resources and storage works.
CO 2	List the principles of mathematics in finding the irrigation requirements.
CO 3	Know the responsibility of a civil engineer for constructions of canal outlets, canal escapes; cross drainage works in reducing the floods.
CO 4	Design hydraulic structures and regulatory works using different methods
CO 5	Predict the cost benefit analysis and give insights for the benefit of society.

UNIT- I

Spillways: Types of Spillways – Necessity and Components of Spillways – Applications of Spillways – Design Principles of Ogee Spillways – Types of Spillway Gates – Energy Dissipation Methods.

UNIT – II

Canal Structures – 1 : Types of Falls and Their Location – Design Principles of Sarda type Fall – Trapezoidal Notch Fall and Straight Glacis Fall.

UNIT – III

Canal Structures – 2: Canal Regulation Works – Principles of Design of Distribution and the Head Regulator – Canal Outlets – Types of Canal Modules – Proportionality Sensitivity and Flexibility.

UNIT - IV

Cross Drainage Works: Types of Selection of Site – Design Principles of Aqueduct – Siphon Aqueduct and Super Passage.

UNIT - V

Water Resources Planning: Introduction to Indian Water Resources – Scenario of Water Use – Purpose of Water Resource Development – Classification of Water Resources –

Development Projects – Simulation – Process of Project Formulation – Project Evaluation – Strategies for Future – Planning Strategies – Management Strategies.

Text Books:

1. G L Asawa "Irrigation and Water Resources Engineering", New Age International (P) Limited, Publishers, New Delhi.
2. R S Varshney, S C Gupta and R L Gupta "Theory and Design of Irrigation Structures", Nem Chand & Bros Publishers, Roorkee, Uttarakhand.
3. Irrigation and water resources engineering by G.L. Asawa, New Age International Publishers
4. Water resources engineering by Satyanarayana Murthy. Challa, New Age International Publishers

Reference Books:

1. Satya Narayana Murty Challa "Water Resources Engineering – Principles and Practice", New Age International (P) Limited, Publishers, New Delhi.
2. B C Punmia, Pande B B Lal, Ashok Kumar Jain & Arun Kumar Jain "Irrigation and Waterpower Engineering", Lakshmi Publications, New Delhi.
3. Irrigation and Water Power Engineering by Punmiaand Lal, Laxmi Publications, New Delhi.
4. Irrigation engineering and hydraulic structures by S.K Garg, Khanna publishers.

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K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

B. Tech., VII Semester

Course Title	Pre-Stressed Concrete				B. Tech. VII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1501706	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

Course Objective:

- To give idea on methods available on pre-stressed concrete and analysis of pre-stressed members and design of members

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Calculate the effect of prestressing on statically determinate structures and statically indeterminate structures.
CO 2	Design, analysis, detailing and construction of prestressed concrete structural.
CO 3	Distinguish between pre-tensioning technology and post-tensioning technology.
CO 4	List the differences between pre- and post-tensioned systems for structural
CO 5	. Design and analyze prestressed concrete and concrete composite structures.

UNIT- I

Introduction and Systems of Pre-Stressing:

Introduction: General Principles of Pre-Stressed Concrete Members – Advantages and Limitations of Pre-Stressed Concrete – Comparison of Pre-Stressed Concrete Beams with Reinforced Concrete Beams.

Systems of Pre-Stressing: Classification of Pre-Stressed Concrete Members, System of Pre-Stressing, Pre-Tensioned System, Stability of the System. Hoyer System, Magnel Blaton System, Freyssinet System, Gifford Udall System, P.S.C Mono Wire System, C.C.L Standard System, LEE-MCCALL System.

UNIT – II

Losses of Pre-Stresses: Loss of Pre-Stress in Pre-Tensioned and Post-Tensioned Due to Various Causes Like Elastic Shortening of Concrete, Shrinkage of Concrete, Creep of Concrete, Relaxation of Stress in Steel, Slip in Anchorage Bending of Member and Wobble Frictional Losses.

UNIT – III

Analysis and design of sections for flexure: Assumptions, Analysis by Stress Concept – Elastic Analysis of Concrete Beams Pre-Stressed with Straight, Concentric, Eccentric, Bent and Parabolic Tendons – Design of Pre-Stressed Concrete Beams – I.S Recommendations as per IS 1343 Code Book – Design of Rectangular and an I-Section of a Beam – Lever Arm Concept – Kern Distance.

UNIT - IV

Shear Design of PSC Beam: Design of Shear based on IS 1343 Code Book – Design of Beam

UNIT - V

Deflections of Pre-Stressed Concrete Beams: Importance of Control of Deflections – Factors Influencing Deflections – Short Term Deflections of Uncracked Members Prediction of Long Term Deflections.

Text Books:

1. S Ramamrutham "Pre-Stressed Concrete", Dhanpat Rai Publishing Company (P) Limited, New Delhi.
2. N Krishna Raju "Pre-Stressed Concrete", Tata McGraw-Hill Companies, Inc. New York.
3. N Rajagopalan "Pre-Stressed Concrete", Narosa Publishing House, New Delhi.
4. Prestressed Concrete Structures by M.K.Hurst, Tata Mc.Graw Hill Publications, 2nd Edition,2009 4

Reference Books / IS Codes:

1. IS 1343-2012 "Indian Standard Code of Practice for Prestressed Concrete", Bureau of Indian Standards, New Delhi.
2. Prestressed Concrete Structures by P.Dayaratnam, Oxford &IBH Publishers, Fourth Edition.
3. Prestressed Concrete by K. U. Muthu, Agmil Ibrahim, Maganti Janardhana, M. Vijayanand, PHI Publishers, 2016
4. Design of Prestressed Concrete Structures by T.Y. Lin & N.H.Burns, John Wiley & Sons, 3rd Edition,2005

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K.S.R.M. College of Engineering
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KADAPA - 516 003. (A.P.)

B. Tech., VII Semester

Course Title	Advanced Foundation Engineering					B. Tech. VII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1501707	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Objective:

- To explain how the earth pressure acting on sheet pile
- To explain the concepts of braced cuts and how to calculate the lateral pressure at different locations
- To explain the concepts of Terzaghi and IRC Methods and individual components
- To explain the concepts of collapsible and expansive soils and design of foundations
- To explain different methods of ground improvement techniques

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Design the depth of embedment for sheet pile and forces in the anchor.
CO 2	Determine the loads / forces on the struts and bending moment in wales, sheet piles and design of coffer dam
CO 3	Determine the pressures and to design the well foundation
CO 4	Determine the swell, uplift capacity and factor of safety
CO 5	Importance and difficulties in stabilization

UNIT- I

Bulkheads: Types of Sheet Pile Walls – Free Cantilever Sheet Pile – Cantilever Sheet Pile in Cohesionless and Cohesive Soils – Anchored Sheet Pile with Free Earth Support – Rowe's Moment Reduction Curves – Anchored Sheet Pile with Fixed Earth Support – Design of Anchors.

UNIT - II

Braced Cuts and Coffer Dams:

Braced Cuts – Introduction – Lateral Earth Pressure on Sheetings – Different Types of Sheeting and Bracing Systems – Design of Various Components of Bracings.

Coffer Dams – Types of Coffer Dams – Design of Circular Coffer Dams on Rock – Design of Cellular Coffer Dams on Soil.

UNIT – III

Well Foundations: Introduction – Different Shapes of Wells – Grip Length – Forces Acting on the Well Foundation – Terzaghi's Analysis – Banerjee and Gangopadhyay's Analysis – Simplified Analysis for Heavy Wells – IRC Method – Individual Components of the Well – Sinking of Wells – Measures for rectification of Tilts and Shifts..

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT - IV

Foundations on Collapsible and Expansive Soils:

Collapsible Soils – General Considerations and observations – Computation of Collapse Potential and Settlement – Foundation Design – Treatment Methods.

Expansive Soils – Distribution of Expansive Soils – General Characteristics – Clay Mineralogy and Mechanism of Swelling – Definition of Some Parameters – Evaluation of Swelling Potential of Expansive Soils – Classification of Swelling Soils by Indirect Measurement – Swelling Pressure by Direct Measurements – Effect of Initial Moisture Content and initial Dry Density on Swelling Pressure – Estimating the Magnitude of Swelling – Design of Foundations in Swelling Soils – Elimination of Swelling.

UNIT - V

Soil Stabilization: Introduction – Mechanical Stabilization – Cement Stabilization – Lime Stabilization – Bituminous Stabilization – Chemical Stabilization – Thermal Stabilization – Electrical Stabilization – Stabilization by Grouting – Stabilization by Geo-Textile and Fabrics – Reinforced Earth.

Text Books:

1. Dr. K R Arora "Soil Mechanics & Foundation Engineering", Standard Publishers Distributers, New Delhi.
2. V N S Murthy "Advanced Foundation Engineering", C B S Publishers & Distributors, New Delhi.
3. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain "Soil Mechanics & Foundation Engineering", Lakshmi Publications, New Delhi.
4. Dr. P Purushothama Raj "Ground Improvement Techniques", Lakshmi Publications, New Delhi.

Reference Books:

1. Joseph E. Bowles "Foundation analysis & Design", Tata McGraw-Hill Companies, Inc. New York.
2. Braja M Das "Principles of Foundation Engineering", Thomson Publishers, United States.
3. N N Som & S C Das "Theory and Practice of Foundation Design", Prentice-Hall of India (P) Limited, New Delhi.
4. P Purushothama Raj "Soil Mechanics and Foundation Engineering", Pearson Education India, New Delhi.

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(Autonomous)
KADAPA - 516 003. (A.P.)

B. Tech., VII Semester

Course Title	Construction Planning and Management					B. Tech. VII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1501708	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Objective:

- Understand the importance of construction management, resource management and what the stages of construction activity are?
- To know how to prepare scheduling in construction activity. significance of pert and CPM and make use of these two techniques how to develop a network diagram for construction
- To know various types of equipments in construction and their usage in varied works usage of mechanization and its effect on productivity. Applications of machinery in different types of constructions are?
- Understand importance of inspection and how to maintain quality in different stages. Recognize the standards of materials and effective utilization of skilled persons in construction. Effect of ethical procedures in construction.
- To know the importance of safety measures in construction activity, effect of safety benefits to construction workers. Understand the importance of organization and know how to maintain communications in construction.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	List the various stages and implementation of management skills in construction
CO 2	Possibility usage of sophisticated equipment in construction
CO 3	The basics in quality maintains in various stages
CO 4	The importance of organization and how correspondence carried out in construing industry.

UNIT- I

Introduction: Significance of Construction Management – Objectives and Functions of Construction Management – Types of Construction – Resources for Construction Industry – Stages of Construction – Construction Team and Engineering Drawings.

UNIT – II

Construction Planning and New Techniques in Construction Management:

Construction Planning: Stages of Planning – Scheduling, Preparation of Material – Equipment – Labour and Finance Schedules – Bar Charts and Mile Stone Charts

New Techniques in Construction Management: Programme Evaluation Review Technique (PERT) and Critical Path Method (CPM) – Break Down of Structures – Classification of

Activities – Rules for Developing Networks – Network Development and Analysis – Critical Activities – Critical Path and Cost Optimization.

UNIT - III

Construction Equipment and Management: Equipment Requirements in Construction Industry, Heavy Earth Moving Equipment – Bulldozers, Scrapers, Loaders Shovels and Cranes – Compaction Equipment, Grading Equipment, Aggregate Production Equipment, Asphalt Mixing Plant and Asphalt Laying Plant, Hauling Equipment, Concrete Mixing Equipment, Material Handling Devices, Pneumatic Equipment, Bridge Construction Equipment, Drilling and Blasting Equipment, Pumping and Dewatering Equipment.

UNIT - IV

Inspection and Quality Control, Ethical Audit:

Inspection and Quality Control: Need for Inspection and Quality Control Principles of Inspection – Enforcement of Specifications – Stages of Inspection and Quality Control.

Ethical Audit: Introduction – Aspects of Project Realization – Ethical Audit Procedures – The Decision Makers – Variety of Interest – Formulation of Briefs – The Audit Statement and Reviews.

UNIT - V

Safety and Risk, Organization of Construction:

Safety and Risk: Introduction on Safety and Risk – Concept and Importance of Safety – Types of Risks – Safety and Engineers – Safety Measures in Construction Work – Design for Safety – Risk Benefit Analysis – Accidents.

Organization of Construction: Principles of Organization – Communication – Leadership and Human Relations – Types of Organizations – Organization for Construction – Temporary Services and Job Layout.

Text Books:

1. P S Gahlot and B M Dhir "Engineering Construction Planning and Management", New Age International (P) Limited, Publishers, New Delhi.
2. S C Sharma "Construction Equipment and Its Management", Khanna Publishers, New Delhi.
3. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Building Construction, 10th Edition, Laxmi Publications (P) Ltd., New Delhi, 2010
4. Jha, Construction Project Management,1stEdition, Pearson Publications, New Delhi, 2011

Reference Books:

1. M Govindarajan, S Natarajan and V S Senthilkumar "Engineering Ethics", Prentice-Hall of India (P) Limited, New Delhi.
2. Dr. S Seetharaman "Construction Engineering and Management", Umesh Publications, New Delhi.
3. P.K. Joy, Total Project Management: The Indian Context, 1st Edition, Mac Millan Publishers India Limited, 1993.
4. Horpal Singh "Construction Management and Accounts", Tata McGraw-Hill Companies, Inc. New York.

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KADAPA - 516 003. (A.P.)

B. Tech., VII Semester

Course Title	Concrete & Highway Materials Laboratory				B. Tech. VII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1501709	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	2	50	50	100
Mid Exam Duration: ---					End Exam Duration: 3 Hrs			

Course Objective:

- To conduct laboratory tests to find suitability of materials for design of concrete and bituminous mixes.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Conduct Quality Control tests on concrete making materials, fresh & hardened concrete
CO 2	Design and test concrete mix
CO 3	Characterize the pavement materials and Perform quality control tests on pavements and pavement materials

Part – A Concrete Technology Laboratory

List of Experiments

1. Normal Consistency of fineness of cement.
2. Initial setting time and final setting time of cement.
3. Specific gravity and soundness of cement.
4. Compressive strength of cement.
5. Workability test on concrete by compaction factor, slump and Vee-bee.
6. Young's modulus and compressive strength of concrete.
7. Bulking of Fine aggregate.
8. Non-Destructive testing on concrete (for demonstration)

Part – B Highway Materials Laboratory

List of Experiments

Section – 1 ROAD AGGREGATES:

1. Aggregate Crushing value
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption of Coarse aggregate.
4. Abrasion Test.
5. Shape tests

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(Autonomous)
KADAPA - 516 003. (A.P.)

Section – 2 BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.

Text Books:

1. M S Shetty "Concrete Technology – Theory and Practice", S Chand & Company Limited, New Delhi.
2. S K Khanna, C E G Justo and A Veeraraghavan "Highway Engineering", Nem Chand & Bros Publishers, Roorkee, Uttarakhand.

Reference Books:

1. Hemant Sood, L N Mittal and P D Kulkarni "Laboratory Manual on Concrete Technology", C B S Publishers and Distributors, New Delhi.
2. Ajay K Duggal and Vijay P Puri "Laboratory Manual in Highway Engineering", New Age International (P) Limited, Publishers, New Delhi.
3. G Venkatappa Rao, K Ramachandra Rao, Kausik Pahari and D V Bhavanna Rao "Highway Material Testing and Quality Control", I K International Publishing House Pvt. Limited, New Delhi.

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KADAPA - 516 003. (A.P.)

B. Tech., VII Semester

Course Title	CADD Laboratory					B. Tech. VII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1501710	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	2	50	50	100
Mid Exam Duration: ---						End Exam Duration: 3 Hrs		

Course Objective:

- The student shall learn various commands used in STAAD Pro and their applications.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Analyze the structures for various loading conditions as per Indian codes.
CO 2	Analyze and design 1-D and 2-D structures for various loading conditions.
CO 3	Analyze and design space structures for various loading conditions.
CO 4	Analyze and design of bridges.
CO 5	Analyze and design of industrial structures.

List of Experiments:

1. Introduction to STAAD Pro and basic commands of STAAD Pro. (2 classes)
2. Analysis of simply supported and fixed beams subjected to member forces
3. Analysis and design of continuous beam subjected to member forces
4. Analysis of plane truss subjected to different types of forces
5. Analysis and design of plane frame subjected to member and joint loads
6. Analysis and design of space frame subjected to gravity forces
7. Analysis and design of space frame subjected to wind forces
8. Analysis of beam subjected to moving loads
9. Analysis and design of an industrial structure
10. Analysis and design of a retaining wall
11. One Way Slab Analysis & Design

Softwares:

1. STAAD Pro V8i or Equivalent

Reference Books:

1. G S Suresh and Prakash M N Shesha "Computer Aided Design Laboratory", Lakshmi Publications, New Delhi.

Head
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(Autonomous)
KADAPA - 516 003. (A.P.)

VIII Semester
Syllabus

B. Tech., VIII Semester

Course Title	Sanitary Engineering				B. Tech. VIII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1501801	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

Course Objectives:

- To estimate sewage and storm water from cities and towns for arriving design flows for use in the design of sewage and sewage treatment process units.
- To focus in planning, design and operation of sewerage and sewage treatment units.
- To illustrate different practices in the management of sewage sludges and treated sewage effluent.
- To illustrate different practices in solid waste management.
- To illustrate air and noise pollutions and environmental impact assessment.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Gain skills in the estimation of sewage and storm water for arriving design flows..
CO 2	Become experts in planning, design, and operation and maintenance of sewerage and sewage treatment units.
CO 3	Gain knowledge in the management of treatment plant residues and effluent disposal practices
CO 4	Gain knowledge in character, disposal of solid wastage managements
CO 5	Gain knowledge in air and noise pollution and environmental impact assessment civil engineering projects

UNIT-I

Estimation of Sewage and Strom Water, Collection of Sewage:

Estimation of Sewage and Storm Water: Definition of Terms – Sewage, Sullage, Storm Water and Sludge – Objectives of Sewage and Storm Water Estimations and General Methods Available for Estimations in Urban Areas – Average, Peak and Minimum Sewage Flows and their Importance in Collection and Treatment Systems.

Collection of Sewage: Sewage Collection by Different Sewers and their Functions – Separate and Combined Sewers and their Merits and Demerits – Hydraulic Design of Sewers for Full and Partial Flow System – Self-Cleansing Velocity of Sewers – Sewer Appurtenances and their Location and Functions.

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT – II

Characterization of Sewage, Preliminary and Primary Treatment:

Characterization of Sewage: Objectives of Sewage Characterization – Frequency of Sampling of Sewage for Different Parameters – Chemical Composition of Sewage – Solids, BOD and COD, Nutrients and Biological Impurities – Numerical Problems on BOD Equation – Population Equivalent – Carbon, Nitrogen and Sulphur Cycles.

Preliminary and Primary Treatment: Basic Concept of Sewage Treatment – Preliminary, Primary, Secondary and Tertiary Sewage Treatment Processes – Sewage Treatment Process – Design of Bar Screen, Grit Chamber and Primary Sedimentation Tanks.

UNIT – III

Secondary Treatment: Necessity of Secondary Treatment – Principles of Biological Treatment of Sewage – Suspended and Attached Growth of Biological System – Design of Conventional type of Activated Sludge Processes – Aerated Lagoons and Oxidation Ponds – Design of Secondary Sedimentation Tanks – Operational Problems of Biological Treatment Process Units.

UNIT – IV

Tertiary Treatment and Sludge Management:

Tertiary Treatment: Objectives of Tertiary Treatment – Removal of Nitrogen, Phosphorus, and Refractory Organics from Secondary Treated Sewage – Standards for Disposal of Treated Sewage into Inland Surface Waters, Marine Disposal and on Land for Invigation.

Sludge Management: Sludge Stabilization by Aerobic and Anaerobic Processes – Sludge Dewatering Practices – Sludge Drying Beds and Centrifugation. Sludge Disposal Practices – Design of Septic Tank and Soak Pits.

UNIT – V

Solid Waste Management, Air and Noise Pollution:

Solid Waste Management: Sources, Characteristics and Generation of Solid Wastes – Collection and Disposal – Design and Management of Sanitary Landfills.

Air and Noise Pollution: Types of Air Pollutants – Sources and Effect of Air Pollution – Air Pollution Metrology – Air Pollution Control – Air Quality Standards and Limits – Sources and Effects of Noise Pollution – Measurement of Noise and Control of Noise Pollution – Permissible Limits of Noise Pollution.

Text Books:

1. S K Garg, "Environmental Engineering Vol.1", Khanna Publishers, New Delhi.
2. B C Punmia, Ashok Kumar Jain and Arun Kumar Jain "Water Supply Engineering", Lakshmi Publications, New Delhi.
3. Environmental Engineering by H. S Peavy, D. R. Rowe, G. Tchobanoglous, McGraw Hill Education (India) Pvt Ltd, 2014.
4. Waste water engineering by Metcalf and Eddy, McGraw Hill, 2015.

Reference Books:

1. H S Peavy, D R Rowe and G Tehobanoglous "Environmental Engineering", Tata McGraw-Hill Companies, Inc. New York.
2. S K Hussain "Water Supply and Sanitary Engineering", Oxford & IBH, New Delhi.

3. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication.
4. Water and Waste Water Technology by Mark J Hammar and Mark J. Hammar Jr.Wiley, 2007.

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KADAPA - 516 003. (A.P.)

B. Tech., VIII Semester

Course Title	Design and Drawing of Irrigation Structures				B. Tech. VIII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1501802	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs		

Course Objectives:

- To study the preliminary and secondary investigations required for hydraulic structures
- To study the different methods for estimating of peak flow
- To study in detail design procedures and their site specific criteria
- To study the different safety measures required for during operations of irrigation structures

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the factors which are used for selecting in constructing various hydraulic structures.
CO 2	To estimate the peak flood and their importance in the design of hydraulic structures and components in the structures.
CO 3	Understand how to develop an irrigation structure as per the suitability of a site.
CO 4	To design the various components of hydraulic structures.
CO 5	Understand various protective works used in hydraulic structures for the safety of submerged

UNIT-I

Design of surplus weir: Introduction – Estimation of Flood Discharge – Selection of type of Work – Length of Surplus Weir – Crest Width Base Width – Abutments – Wings Returns – Aprons.

UNIT – II

Canal Drop (Notch Type): Trapezoidal Notch Length of Drop Wall Between Abutments – Profile of Drop Wall – Notch Pier – Protective Works.

UNIT – III

Tank Sluice with Tower Head: Vent Way Design – Sluice Barrel Tower Head – R.C Slab – Earth Pressure – Stability Analysis – Tower Head Design – Cistern.

UNIT – IV

Canal Regulator Cum Road Bridge: Vent Way Design – Drowning Ratio Method – Roadway – Piers Shutters, Abutments – Wing Walls – Return Walls – Return Walls – Solid Apron for Regulator – Revetments – Energy Dissipation.

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT – V

Under Tunnel: Design of Barrel Roof – Abutments Pressure Under Pier – Fixing Maximum Flood Levels Rail Channel – Afflux over Drop Wall – Loss of Head Calculation – Depth of Foundation Return Walls – Wing Walls and Return – Uplift – Creep Lost in Percolation.

Text Books:

1. C Satyanarayana Murty "Water Resources Engineering – Principles and Practice", New Age International (P) Limited, Publishers, New Delhi.

Reference Books:

1. Santosh Kumar Garg "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi.
2. N Balasubramanya "Hydraulic Structures and Irrigation Design Drawing", Sapna Book House and Publishers, Bangalore.

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(Autonomous)
KADAPA - 516 003. (A.P.)

B. Tech., VIII Semester

Course Title	Quantity Surveying and Valuation					B. Tech. VIII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1501803	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Objectives:

- To know the qualitative of different item of works and workman ships. Understand the types and methods of Estimations. Be aware of the influence of specifications on estimation.
- To understand how to prepare the rate of all items of works involved in construction and what are factors influencing the rate analysis.
- To emphasizes on preparation quantities of item of works with different methods
- To expertise how to prepare bar bending schedule for structural elements
- To study the importance of contractual system and how to evaluate the valuation of any structure after completion of certain age.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Known about the quality implementation during the construction with follow of specifications.
CO 2	Expertise to prepare the rates of all possible items of works involved in construction
CO 3	Erudite the different methods of estimation of various item of work and expertise to prepare bar bending schedule
CO 4	Known about the basics to prepare the quantities of irrigation and road structures
CO 5	Studied how to prepare tender schedule and how to finalize the tender. Know-how to prepare the valuation of the given structure

UNIT-I

Specifications and Introduction to the Estimation of Structures:

Specifications: Specification of Different Items of Works: Types - Standard Specifications for Different Items of Building Construction – Earth Work for Foundations, Mortars, Foundation Concrete, Reinforced Concrete, Brick Work, Stone Masonry, Mosaic Flooring, Terrazo Flooring, RCC Roof and AC Roof and GI Sheets, Plastering, Painting, Pointing and Wood Works.

Introduction to the Estimation of Structures: Introduction, Different Item of Works – Units of Item of Works – Types of Estimates – Methods of Estimates

Head
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K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT – II

Rate Analysis: Rate Analysis of Different Item of Works: Earthwork Excavation – Mortars of Various Proportions (Cement and Lime) – Concrete with Various Proportions (Lime and Cement) – Brick Masonry – Stone Masonry – Pointing – Painting – Plastering – Aluminum Partitions – Wooden Partitions – Cement Concrete Flooring With 1:2:4 Mix – Ceramic and Vitrified Tile Flooring and Mosaic Flooring.

UNIT – III

Quantity Estimation of Buildings and Bar Bending Schedule: Estimation of Quantities in Buildings: Load Bearing Wall Structure of Single Room, Double Room and Multi Room.

UNIT – IV

Estimation of Bar Bending Schedule: Beams - Slabs – Staircases – Sun Shade – Lintels – Portico

UNIT – V

Contracts and Valuation:

Contracts: Types of Contracts, Contract Document, Conditions of Contracts, Contract Procedure, Termination of Contracts, Specifications, Important Conditions of Contract, Arbitration and Tenders.

Valuation: Introduction, Technique of Valuation, Elements of Valuation and Factors Affecting Valuation, Methods of Valuation to the Land Property and Building Property, Mortgage.

Text Books:

1. B N Dutta "Estimating and Costing in Civil Engineering", U B S Publishers Distributers Pvt. Limited, Noida.
2. "Standard Data Book – Vol.2", Andhra Pradesh Department of Standard Specifications, Amaravathi
3. Contracts and estimations by B.S.Patil, Universities.Press, Hyderabad
4. Estimation, Costing and Specifications by M. Chakraborthi; Laxmi publications

Reference Books:

1. Dr. Roshan H Namavati "Professional Practice", The Lakhani Book Depot, Mumbai.
2. S C Rangwala "Estimating Costing and Valuation", Charotar Publishing House Pvt. Limited, Anand.
3. Estimation, Costing and Specifications by M. Chakraborthi; Laxmi publications
4. Engineering construction cost by Peurifoy , TMH Publishers

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Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

B. Tech., VIII Semester

Course Title	Finite Element Method					B. Tech. VIII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1501804	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Objectives:

- To understand the concepts of Finite element methods to analyze critical stress conditions in structures.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understanding of the fundamental theory of the FEM
CO 2	Develop the ability to generate the governing FE equations for systems governed by partial differential equations
CO 3	Understand the use of the basic finite elements for structural applications using truss, beam, frame and plate elements
CO 4	Able to develop suitable software tools for analysis purpose

UNIT-I

Introduction to Finite Element Method: Introduction - Finite Difference Method - Advantages and Disadvantages - Basic Steps – Limitations - Finite Element Modeling and Discretization - Types of Elements - Nodes and Degrees of Freedom - Interpolation and Shape Functions

UNIT – II

One Dimensional & Two Dimensional Elements: Stiffness matrix for bar element – shape functions for one dimensional elements – one dimensional problems .Two Dimensional Elements - Different types of elements for plane stress and plane strain analysis – Displacement models – generalized coordinates – shape functions – convergent and compatibility requirements – Geometric invariance – Natural coordinate system – area and volume coordinates

UNIT – III

Trusses: Plane Trusses - Local and Global Coordinate Systems - Direction Cosines - Element Stiffness Matrix - Assembly of Global Stiffness Matrix - Stress Calculation.

UNIT – IV

Beams: Introduction Beam Stiffness - Assembly of Beam Stiffness Matrix – Loading - Boundary Conditions - Plane Stress - Plane Strain Analysis

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT – V

Iso-parametric Elements and Finite Element Modeling: Mesh Requirements - Material Properties - Loads and Reactions - Boundary Conditions - Checking the Model - Analysis and Design Software (For Practice Purpose Only)

Solution Techniques: Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads.

Text Books:

1. Daryl L Logan "A First Course in the Finite Element Method", Cengage Learning India Private Limited, New Delhi.
2. S S Bhavikatti "Finite Element Analysis", New Age International (P) Limited, Publishers, New Delhi.
3. Finite Element analysis – Theory & Programming by C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers
4. Finite element analysis by S.S. Bhavakatti-New age international publishers

Reference books:

1. Robert D Cook, David S Malkus and Michael E Plesha "Concepts and Applications of Finite Element Analysis", Wiley India Pvt. Limited, New Delhi.
2. George R Buchanan "Theory and Problems of Finite Element Analysis", Tata McGraw-Hill Companies, Inc. New York.
3. Finite element analysis and procedures in engineering by H.V.Lakshminaryana, 3rd edition, universities press, Hyderabad.
4. Finite Element Analysis for Engineering and Technology, Tirupathi R Chandraputla, Universities Press Pvt Ltd, Hyderabad. 2003.

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

B. Tech., VIII Semester

Course Title	Environmental Impact Assessment					B. Tech. VIII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1501805	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Objectives:

- Deals with the various impacts of infrastructure projects on the components of environment and method of assessing the impact and mitigating the same.
- The student is able to know about the various impacts of development projects on environment and the mitigating measures.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Perform a critical quality review of an EIA and EIS.
CO 2	Structure the EIA working process considering the need for interdisciplinary.
CO 3	Perform the screening and scoping of an EIA, based on existing requirements, evaluate the impacts and draw meaningful conclusions from the results of the EIA.
CO 4	Clarify the concept of EIA and its application in an international context to those involved in or affected by the EIA process.
CO 5	Interpretate an EIA, present its conclusions and translate its conclusions into actions.

UNIT-I

Basic Concepts of EIA: Initial Environmental Examination – Elements of EIA – Factors Affecting E-I-A – Impact Evaluation and Analysis – Preparation of Environmental Base Map – Classification of Environmental Parameters.

UNIT – II

EIA Methodologies: Introduction – Criteria for the Selection of EIA Methodology – E I A Methods – Ad-Hoc Methods – Matrix Methods – Network Method – Environmental Media Quality Index Method – Overlay Methods and Cost/Benefit Analysis

UNIT – III

Impact of Developmental Activities and Land Use: Introduction and Methodology for the Assessment of Soil and Ground Water – Delineation of Study Area – Identification of Actives – Procurement of Relevant Soil Quality – Impact Prediction – Assessment of Impact Significance – Identification and Incorporation of Mitigation Measures – E I A in Surface Water – Air and Biological Environment – Methodology for the Assessment of Impacts on Surface Water Environment – Air Pollution Sources – Generalized Approach for Assessment of Air Pollution Impact.

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT – IV

Assessment of Impact on Vegetation and Wildlife, Environmental Audit:

Assessment of Impact on Vegetation and Wildlife: Introduction – Assessment of Impact of Development Activities on Vegetation and Wildlife –Environmental Impact of Deforestation – Causes and Effects of Deforestation.

Environmental Audit: Introduction - Environmental Audit & Environmental Legislation – Objectives of Environmental Audit – Types of Environmental Audit – Audit Protocol – Stages of Environmental Audit – Onsite Activities – Evaluation of Audit Data and Preparation of Audit Report.

UNIT – V

Unit - 5 Environmental Acts (Protection and Prevention): Post Audit Activities – The Environmental Protection Act – The Water Prevention Act – The Air (Prevention and Control of Pollution Act) – Wild Life and Preparation of Environmental Impact Assessment Statement for Various Industries.

Text Books:

1. Y Anjaneyulu and Valli Manickam "Environmental Impact Assessment Methodologies", B S Publications, Sultan Bazar, Hyderabad.
2. J Glynn Henry and Gary W Heinke "Environmental Science and Engineering", Prentice-Hall of India (P) Limited, New Delhi.
3. Environmental Science and Engineering, by Suresh K. Dhaneja – S.K.,Katari & Sons Publication., New Delhi.

Reference Books:

1. Dr. Suresh K Dhameja "Environmental Science and Engineering", S K Kataria & Sons Publishers, New Delhi.
2. H S Bhatia "Textbook on Environmental Pollution and Control", Galgotia Publications Pvt. Limited, New Delhi.
3. Rau and Wooten "Environmental Impact Analysis Handbook", Tata McGraw-Hill Companies, Inc. New York.

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

B. Tech., VIII Semester

Course Title	Bridge Engineering				B. Tech. VIII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1501806	Professional Major (PJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	0	3	30	70	100
Mid Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

Course Objectives:

- Bridges and its components- different types of loadings and irc classification of loadings and its importance
- Bridges and box culverts and its design procedure.
- Bridge bearings and its importance and plate girder bridges and its design procedure.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Students are effectively learned the bridges and various loads are acting on the bridges.
CO 2	Students understand the deck slab and its various loadings
CO 3	Students understood the t-beam bridge and its components and various loads acting on the t-beam bridges effectively.
CO 4	Composite bridges and its design and shear connectors are designed by the students
CO 5	All of the components of the bridges and loads are learned by the students effectively.

UNIT-I

Introduction: Importance of Site Investigation in Bridge Design – Highway Bridge Loading Standards – Impact Factor – Railway Bridge Loading Standards (B.G & M G Bridges) – Various Loads in Bridges.

UNIT – II

Box Culvert: General Aspects – Design Loads – Design of Box Culvert Subjected to R C Class AA Tracked Vehicles only.

UNIT – III

Design of Deck Slab Bridge: General Features – Effective Width Method of Analysis Design of Deck Slab Bridge (Simply Supported) subjected to Class AA Tracked Vehicles only.

UNIT – IV

Design of T-Beam Bridge: General Features – Design of Interior Panel of Slab – Pigeauds Method – Design of a T- Beam Bridge Subjected to Class AA Tracked Vehicles only.

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT – V

Piers, Abutments and Bridge Bearings: General Features – Bed Block – Material Piers & Abutments – Types of Piers – Forces Acting on the Piers – Stability Analysis of Piers – General Features of Abutments – Forces Acting on Abutments – Stability Analysis of Abutments – Types of Wing Walls – Approaches – Types of Bridge Foundations (Excluding Design)

Bridge Bearings: General Features – Types of Bearings – Design Principles of Rocker & Roller Bearings – Design of Steel Rocker Bearings – Design of Elastomeric Pad Bearings

Text Books:

1. S Ponnuswamy "Bridge Engineering", Tata McGraw-Hill Companies, Inc. New York.
2. N Krishna Raju "Design of Bridges", Oxford & IBH Publishing Company (P) Limited, New Delhi.
3. D Johnson Victor "Essentials of Bridge Engineering", Oxford & IBH Publishing Company (P) Limited, New Delhi.
4. IRC 83-2000 "Standard Specifications and Code of Practice for Different Types of Bridge Bearings used in the Bridges and its Detailed Specifications", The Indian Road Congress, New Delhi.

Reference Books:

1. IS 800-2007 "Indian Standard Code of Practice for General Construction in Steel", Bureau of Indian Standards, New Delhi.
2. IS 456-2000 "Indian Standard Plain and Reinforced Concrete – Code of Practice", Bureau of Indian Standards, New Delhi.
3. IRC 6-2000 "Standard Specifications and Code of Practice for Different Types of Loadings Acting on the Bridge Structure", The Indian Roads Congress, New Delhi.
4. IRC 22-2000 "Standard Specifications and Code of Practice for Road Bridges and Different Materials used in Bridge Structures and Reinforcement Details", The Indian Road Congress, New Delhi.
5. IRC 24-2000 "Standard Specifications and Code of Practice for Permissible Bending Stresses in Steel and its Properties", The Indian Road Congress, New Delhi.

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

Regulations for UG Program in Engineering (R18 UG)

(Effective from 2018-19 for regular students and 2019-20 for lateral entry students)

B. Tech (R18) Syllabus
Civil Engineering

Kandula Srinivasa Reddy Memorial College of Engineering (Autonomous)

Kadapa-516005. AP

(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC)

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UG Programs in Civil Engineering (R18 UG)

Curriculum

1st Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1821101	BSC	Mathematics – 1	3	1	0	30	70	4
1823102	BSC	Engineering Chemistry	3	1	0	30	70	4
1824103	HSMC	English	2	0	0	30	70	2
1805104	ESC	Programming for Problem Solving	3	0	0	30	70	3
1823107	BSC	Chemistry Lab	0	0	3	50	50	1.5
1805108	ESC	Programming for Problem Solving Lab	0	0	4	50	50	2
1824109	HSMC	English Lab	0	0	2	50	50	1
		Total	**11**	**2**	**9**	**270**	**430**	**17.5**

2nd Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1821201	BSC	Mathematics – 2	3	1	0	30	70	4
1822204	BSC	Engineering Physics	3	1	0	30	70	4
1802205	ESC	Basic Electrical Engineering	3	1	0	30	70	4
1803207	ESC	Engineering Graphics and Design	1	0	4	50	50	3
1822208	BSC	Engineering Physics Lab	0	0	3	50	50	1.5
1802209	ESC	Basic Electrical Engineering Lab	0	0	2	50	50	1
1803211	ESC	Workshop and Manufacturing Practice	1	0	4	50	50	3
		Total	**11**	**3**	**13**	**290**	**410**	**20.5**

3rd Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1823301	BSC	Biology for Engineers	2	0	0	30	70	2
1821302	BSC	Numerical Methods, Probability & Statistics	2	1	0	30	70	3
1803303	ESC	Basic Mechanical Engineering	2	1	0	30	70	3
1801304	PCC	Engineering Mechanics	3	1	0	30	70	4
1801305	PCC	Surveying and Geomatics	2	1	0	30	70	3
1801306	PCC	Building Materials and Construction	2	1	0	30	70	3
1801307	PCC	Computer Aided Civil Engineering Drawing Lab	0	0	4	50	50	2
1801308	PCC	Surveying and Geomatics Lab	0	0	2	50	50	1
1801309	PCC	Civil Engineering Workshop	0	0	2	50	50	1
		Total	**13**	**5**	**8**	**330**	**570**	**22**

4th Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1825401	OEC 1	Managerial Economics & Financial Analysis	3	0	0	30	70	3
1824402	HSMC	Effective Technical Communication	2	1	0	30	70	3
1801403	PCC	Engineering Geology	2	0	0	30	70	2

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

1801404	PCC	Fluid Mechanics	3	1	0	30	70	4
1801405	PCC	Solid Mechanics – 1	3	1	0	30	70	4
1801406	PCC	Disaster Preparedness & Planning Management	2	0	0	30	70	2
18994M1	MC 1	Environmental Studies	2	0	0	30	0	0
1801407	PCC	Engineering Geology Lab	0	0	2	50	50	1
1801408	PCC	Fluid Mechanics Lab	0	0	3	50	50	1.5
1801409	PCC	Solid Mechanics Lab	0	0	3	50	50	1.5
		Total	**17**	**3**	**8**	**360**	**570**	**22**

5th Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
18995M1	MC 2	Human Values and Professional Ethics	2	0	0	30	0	0
1801501	PCC	Solid Mechanics – 2	2	1	0	30	70	3
1801502	PCC	Hydraulic Machinery	2	0	0	30	70	2
1801503	PCC	Structural Analysis – 1	2	1	0	30	70	3
1801504	PCC	Geotechnical Engineering	2	1	0	30	70	3
1801505	PCC	Environmental Engineering	2	0	0	30	70	2
1801506	PCC	Transportation Engineering	2	0	0	30	70	2
PEC 1	PEC 1	RS & GIS	2	0	0	30	70	2
1801514	PCC	Geotechnical Engineering Lab	0	0	2	50	50	1
1801515	PCC	Transportation Engineering Lab	0	0	2	50	50	1
1801516	PCC	Environmental Engineering Lab	0	0	2	50	50	1
1801517	PROJ	Socially Relevant Project	0	0	3	100	0	2
		Total	**16**	**3**	**9**	**490**	**640**	**22**

6th Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1814601	ESC	Basic Electronics and Sensor Technology	2	0	0	30	70	2
1801602	PCC	Concrete Technology	2	0	0	30	70	2
1801603	PCC	Structural Analysis – 2	2	1	0	30	70	3
1801604	PCC	Design of Reinforced Concrete Structures – 1	2	1	0	30	70	3
1801605	PCC	Foundation Engineering	2	0	0	30	70	2
1801606	PCC	Water Resources Engineering – 1	2	1	0	30	70	3
PEC 2	PEC 2	Port and Harbour Engineering	2	0	0	30	70	2
1814613	ESC	Basic Electronics and Sensor Technology Lab	0	0	2	50	50	1
1801614	PCC	Concrete Technology Lab	0	0	2	50	50	1
1801615	PCC	Foundation Engineering Lab	0	0	2	50	50	1
1801616	PROJ	Internship	0	0	3	100	0	2
		Total	**14**	**3**	**9**	**460**	**640**	**22**

7th Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1801701	PCC	Engineering Economics, Estimation & Costing	2	0	0	30	70	2

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

1801702	PCC	Design of Reinforced Concrete Structures – 2	2	1	0	30	70	3
1801703	PCC	Design of Steel Structures	2	0	0	30	70	2
1801704	PCC	Water Resources Engineering – 2	2	0	0	30	70	2
1801705	PCC	Sanitary Engineering & Solid Waste Management	2	0	0	30	70	2
PEC 3	PEC 3		2	0	0	30	70	2
OEC 2	OEC 2		3	0	0	30	70	3
OEC 3	OEC 3		3	0	0	30	70	3
1801715	PROJ	Project – 1 (Project work, seminar and internship in industry or at appropriate work place)	0	0	12	100	0	3
		Total	**18**	**1**	**12**	**340**	**560**	**22**

8th Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1899801	MC 3	Organisational Behaviour	2	0	0	30	0	0
1801802	PCC	Repairs & Rehabilitation of Structures	2	0	0	30	70	2
PEC 4	PEC 4		2	0	0	30	70	2
OEC 4	OEC 4		3	0	0	30	70	3
1801809	PROJ	Project – 2 (Continued from 7th Semester, Project work, seminar and internship in industry or at appropriate work place)	0	0	12	50	50	5
		Total	**9**	**0**	**12**	**170**	**260**	**12**

Professional Elective Courses

Subject	PEC 1	PEC 2	PEC 3	PEC 4
Structural Engineering	1. Pre-stressed Concrete	1. Advanced Concrete Structures 2. Design of Structural Systems (Tall Buildings)	1. Advanced Structural Analysis by Matrix Methods	1. Bridge Engineering 2. Finite Element Methods
Geotechnical Engineering	1. Ground Improvement Techniques 2. RS & GIS		1. Advanced Foundation Engineering 2. Soil Dynamics & Machine Foundation	1. Environmental Geo-Technology
Transportation Engineering	1. Highway Construction and Management 2. Railway Engineering	1. Airport Planning and Design 2. Port and Harbour Engineering	1. Intelligent Transportation Systems	1. Urban Transportation Planning.
Construction			1. Construction	

Engineering & Management			Project Planning & Systems	
Environmental Engineering		1. Environmental Laws and Policy	1. Environmental Impact Assessment	
Hydraulics, Hydrology & Water Resources Engineering	1. Surface Hydrology	1. Urban Hydrology and Hydraulics	1. Integrated Watershed Management	1. Design and Drawing of Irrigation Structures

List of Professional Elective Subjects for R18 Curriculum

1801508 - Prestressed Concrete
1801509 - Ground Improvement Techniques
1801510 - RS & GIS
1801511 - Highway Construction and Management
1801512 - Railway Engineering
1801513 - Surface Hydrology
1801607 - Advanced Concrete Structures
1801608 - Design of Structural Systems (Tall Buildings)
1801609 - Airport Planning and Design
1801610 - Port and Harbour Engineering
1801611 - Environmental Laws and Policy
1801612 - Urban Hydrology and Hydraulics
1801706 - Advanced Structural Analysis by Matrix Methods
1801707 - Advanced Foundation Engineering
1801708 - Soil Dynamics & Machine Foundation
1801709 - Intelligent Transportation Systems
1801710 - Construction Project Planning & Systems
1801711 - Environmental Impact Assessment
1801712 - Integrated Watershed Management
1801803 - Bridge Engineering
1801804 - Finite Element Methods
1801805 - Environmental Geo-Technology
1801806 - Urban Transportation Planning
1801807 - Design and Drawing of Irrigation Structures

List of Open Elective Subjects for R18 Curriculum

18OE101 - Engineering Mechanics
18OE102 - Surveying
18OE103 - Building Technology
18OE104 - Estimating and Costing
18OE105 - Water Supply Engineering
18OE106 - Construction Practice and Management
18OE107 - Disaster Preparedness
18OE108 - Rehabilitation of Structures

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

List of Honours Subjects for R18 Curriculum

1892101 - Highway Construction and Management
1892102 - Railway Engineering
1892103 - Ground Improvement Techniques
1892104 - Airport Planning and Design
1892105 - Advanced Foundation Engineering
1892106 - Soil Dynamics & Machine Foundation
1892107 - Construction Project Planning & Systems
1892108 - Environmental Geo-Technology Construction Practice and Management

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

Regulations for PG Programs in Engineering (R18PG)

(Effective from 2018-19)

M. Tech (R18) Syllabus

Geotechnical Engineering

Kandula Srinivasa Reddy Memorial College of Engineering (Autonomous)

Kadapa-516005. AP

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Annexure-1 Curriculum
For M. Tech (Geo-Technical Engineering)

First Semester

S. No.	Core code	Core/ Elective	Course Name	L	T	P	IM	EM	CR
1	1851101	Core 1	Advanced Soil Mechanics	3	0	0	40	60	3
2	1851102	Core 2	Advanced Foundation Engineering	3	0	0	40	60	3
3	1851103 1851104 1851105	PE 1	1. Soil Structure Interaction 2. Ground Improvement Techniques 3. Pavement Analysis and Design	3	0	0	40	60	3
4	1851106 1851107 1851108	PE 2	1. FEM in Geo-Mechanics 2. Environmental Geo-Technology 3. Critical Soil Mechanics	3	0	0	40	60	3
5	1851109	MLC	Research Methodology & IPR	2	0	0	40	60	2
6	Audit Course		Audit Course-I	2	0	0	40	0	0
7	1851110	Lab 1	Soil Mechanics – 1 Laboratory	0	0	4	50	50	2
8	1851111	Lab 2	Soil Mechanics – 2 Laboratory	0	0	4	50	50	2
			Total	16	0	8	340	400	18

Second Semester

S. No.	Core code	Core/ Elective	Course Name	L	T	P	IM	EM	CR
1	1851201	Core 3	Dynamics of Soil and Foundations	3	0	0	40	60	3
2	1851202	Core 4	Subsurface Investigations and Instrumentation	3	0	0	40	60	3
3	1851203 1851204 1851205	PE 3	1. Offshore Geo-Technical Engineering 2. Computational Geo-Mechanics 3. Engineering Rock Mechanics	3	0	0	40	60	3
4	1851206 1851207 1851208	PE 4	1. Earth Retaining Structures 2. Design of Underground Excavations 3. Physical and Constitutive Modeling on Geo-Mechanics	3	0	0	40	60	3
5	1851209	Project	Mini-Project	0	0	4	100	00	2
6	Audit Course		Audit Course-II	2	0	0	40	00	0
7	1851210	Lab 3	Sub Soil Exploration Laboratory	0	0	4	50	50	2
8	1851211	Lab 4	Geo-Technical Engineering Modeling Laboratory	0	0	4	50	50	2
			Total	14	0	12	400	340	18

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

Third Semester

S. No.	Core code	Core/ Elective	Course Name	L	T	P	IM	EM	CR
1	1851301 1851302 1851303	PE 5	1. Stability Analysis of Slopes 2. Foundation on Weak Rocks 3. Geo-Technical Earthquake Engineering	3	0	0	40	60	3
2	OE		Open Elective Courses	3	0	0	40	60	3
3	1851310	Major Project	Dissertation Stage – 1 (to be continued next semester)	0	0	20	100	00	10
			Total	6	0	20	180	120	16

Fourth Semester

S. No.	Core code	Core/ Elective	Course Name	L	T	P	IM	EM	CR
1	1851401	Major Project	Dissertation Final Stage (continued from 3rd semester)	0	0	32	50	50	16
			Total	0	0	32	50	50	16

List of Audit Courses offered:

Course Codes	Course Name
1870A01	English for Research Paper Writing
1870A02	Disaster Management
1870A03	Sanskrit for Technical Knowledge
1870A04	Value Education
1870A05	Constitution of India
1870A06	Pedagogy Studies
1870A07	Stress Management by Yoga
1870A08	Personality Development through Life Enlightenment Skills

List of Open Elective Courses offered:

Course Codes	Course Name
1871304	Business Analytics
1871305	Industrial Safety
1871306	Operations Research
1871307	Cost Management of Engineering Projects
1871308	Composite Materials
1871309	Waste to Energy

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

I Semester
Syllabus

M. Tech., I Semester

Course Title	Advanced Soil Mechanics					M. Tech. I Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851101	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- To explain about the consolidation theory
- To explain about the strength behaviour of soil under various conditions
- To analyse the stress paths for different practical situations
- To study the critical parameters in soils
- To study the elastic and plastic deformations in soils

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

CO 1	The students obtain the complete knowledge on strength of soil mass
CO 2	The students are able to develop mathematical models for solving different problems in soil mechanics

UNIT - I

Compressibility of Soils: Consolidation Theory (One, Two, and Three Dimensional Consolidation Theories), Consolidation in Layered Soil and Consolidation for Time Dependent Loading, Determination of Coefficient of Consolidation (Casagrande Method and Taylors Method)

UNIT - II

Strength Behavior of Soils: Mohr Circle of Stress; UU, CU, CD Tests, Drained and Undrained Behavior of Sand and Clay, Significance of Pore Pressure Parameters; Determination of Shear Strength of Soil; Interpretation of Triaxial Test Results.

UNIT –III

Stress Path: Drained and Undrained Stress Path; Stress Path With Respect to Different Initial State of the Soil; Stress Path for Different Practical Situations.

UNIT –IV

Critical State Soil Mechanics: Critical State Parameters; Critical State for Normally Consolidated and Over Consolidated Soil; Significance of Roscoe and Hvorslev State

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

Boundary Surface; Drained and Undrained Plane. Critical Void Ratio; Effect of Dilation in Sands; Different Dilation Models.

UNIT –V

Elastic And Plastic Deformations: Elastic Wall; Introduction to Yielding and Hardening; Yield Curve and Yield Surface, Associated and Non-Associated Flow Rule.

Text Books:

1. Atkinson, J.H. and Bransby, P.L, The Mechanics of Soils: An introduction to Critical soil mechanics, McGraw Hill, 1978.
2. Das, B.M., Advanced Soil Mechanics, Taylor and Francis, 2nd Edition, 1997.
3. Wood, D.M., Soil Behavior and Critical State Soil Mechanics, Cambridge University Press, 1990.

Reference Books:

1. Craig, R.F., Soil Mechanics, Van Nostrand Reinhold Co. Ltd., 1987.
2. Terzaghi, K., and Peck, R.B., Soil Mechanics in Engineering Practice, John Wiley & Sons, 1967.
3. Lambe, T.W. and Whitman, R.V., Soil Mechanics, John Wiley & Sons, 1979.

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(Autonomous)
KADAPA - 516 003. (A.P.)

M. Tech., I Semester

Course Title	Advanced Foundation Engineering					M. Tech. I Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851102	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- To emphasize the importance of soil investigations including destructive and non-destructive methods
- To explain the concept of bearing capacity and how to estimate the safe bearing capacity for various foundation system including settlement consideration
- To explain the need and how do analysis the pile and pile group under various soil conditions and the concepts of Terzaghi and IRC Methods and individual components
- To explain the concepts of collapsible and expansive soils and design of foundations
- To analyse the foundations under uplifting loads

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

CO 1	The students will be able to decide the type of foundations to be recommended for construction of different engineering structures
CO 2	The students will be able to design different types of foundations

UNIT - I

Planning of Soil Exploration for Different Projects, Methods of Subsurface Exploration, Methods of Borings Along with Various Penetration Tests

UNIT - II

Shallow Foundations, Requirements for Satisfactory Performance of Foundations, Methods of Estimating Bearing Capacity, Settlements of Footings and Rafts, Proportioning of Foundations Using Field Test Data, IS Codes.

UNIT –III

Pile Foundations, Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations, Pile Group Capacity and Settlement, Negative Skin Friction of Piles, Laterally Loaded Piles, Pile Load Tests, Analytical Estimation of Load- Settlement Behavior of Piles, Proportioning of Pile Foundations, Lateral and Uplift Capacity of Piles.

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(Autonomous)
KADAPA - 516 003. (A.P.)

Well Foundation, IS and IRC Codal Provisions, Elastic Theory and Ultimate Resistance Methods

UNIT –IV

Foundations on Problematic Soils: Foundations for Collapsible and Expansive Soil

UNIT –V

Coffer Dams, Various Types, Analysis and Design Foundations under Uplifting Loads

Text Books:

1. Bowles. J.E., Foundation Analysis and Design, Tata McGraw-Hill International Edition, 5th Edn, 1997.
2. Das B.M., Shallow Foundations: Bearing capacity and settlement, CRC Press, 1999.

Reference Books:

1. Tomlinson M.J., Pile design and construction Practice, Chapman and Hall Publication, 1994.
2. Poulos, H. G. and Davis, F. H., "Pile Foundation Analysis and Design", Wiley and Sons. 1980

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(Autonomous)
KADAPA - 516 003. (A.P.)

M. Tech., I Semester

Course Title	Soil Structure Interaction					M. Tech. I Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851103	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- To study the soil and foundation behaviour
- To analyse the beams on elastic foundations
- To analyse the plates on elastic medium
- To analyse the piles on elastic medium
- To analyse the load prediction on piles

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

CO 1	Students can apply different soil response models for specific problem based on the requirement.
CO 2	Students can analyze footings/rafts resting on soil as beams/plates on elastic foundation and work out design bending moments/shear and displacements.
CO 3	Student can compute pile response for various loading condition for design purpose.

UNIT - I

Soil-Foundation Interaction: Introduction to soil - Foundation interaction problems, Soil behavior, Foundation behavior, Interface, behavior, Scope of soil-foundation interaction analysis, soil response models, Winkler, Elastic continuum, two parameter elastic models, Elastic plastic behavior, Time dependent behavior.

UNIT - II

Beam on Elastic Foundation - Soil Models: Infinite beam, two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.

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K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –III

Plate on Elastic Medium: Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, simple solutions.

UNIT –IV

Elastic Analysis of Pile: Elastic analysis of single pile, Theoretical solutions for settlement and load distribution, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.

UNIT –V

Laterally Loaded Pile: Load deflection prediction for laterally loaded piles, sub-grade reaction and elastic analysis, Interaction analysis, and pile raft system, solutions through influence charts.

Text Books:

1. Structure Soil Interaction - State of Art Report, Institution of structural Engineers, 1978.
2. McCarthy, D.F. Essentials of Soil Mechanics and Foundations, basic geo-techniques (6th Edition), Prentice Hall, 2002.
3. Selvadurai, A.P.S., Elastic Analysis of Soil Foundation Interaction, Elsevier, 1979.
4. Hemsley, J.A, Elastic Analysis of Raft Foundations, Thomas Telford, 1998.

Reference Books:

1. Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design, John Wiley, 1980.
2. Scott, R.F. Foundation Analysis, Prentice Hall, 1981.
3. ACI 336, Suggested Analysis and Design Procedures for Combined Footings and Mats, American Concrete Institute, Dehit, 1988.

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M. Tech., I Semester

Course Title	Ground Improvement Techniques				M. Tech. I Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1851104	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:
To study the problems associated with problematic geo-materials and the methods for their improvement to support buildings and various types of structures

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

CO 1	At the completion of the course the students will be able to understand the different types of ground modification can be done depending upon the site condition, type and purpose of structure to be constructed.

UNIT - I

Dewatering: Introduction - Scope and necessity of ground improvement in Geotechnical engineering- basic concepts and philosophy, Drainage - Ground Water lowering by well points deep wells, vacuum and electro-osmotic methods. Stabilization by thermal and freezing techniques

UNIT - II

Compaction and Sand Drains: In-situ compaction of granular and cohesive soils, Shallow and Deep compaction sand piles – concept, design, factors influencing compaction Blasting and dynamic consolidation – Preloading with sand drains, fabric drains, wick drains etc. – theories of sand drain – design and relative merits.

UNIT –III

Stone Column, Lime Piles and Soil Nailing: Stone column, lime piles – Functions – Methods of installation – design, estimation of load carrying capacity and settlement-slope stability-stability of trenches-lime-sand columns-Root piles, soil nailing – Applications.

UNIT –IV

Earth Reinforcement: Earth reinforcement – Principles and basis mechanism of reinforced earth-reinforced soil retaining structures-simple design, Synthetic and natural fibre based Geo-textiles and their applications. Filtration, drainage, separation, erosion control – case studies

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K.S.R.M. College of Engineering (Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –V

Grouting: Grouting techniques – Types of grout – Suspension and solution grouts – Basic requirements of grout, Grouting equipment – principle of injection-injection methods – properties of treated ground-application of jet grouting-grout monitoring – Electro – chemical stabilization – Stabilization with cement, lime etc. – Stabilization of expansive clays.

Text Books:

1. Dr. P. Purushothama Raj., "Ground Improvement Techniques", Lakshmi Publications Pvt. Ltd.
2. Das, B.M., Principles of Foundation Engineering, (Fourth Edition). PWS Publishing, 1999
3. Jones, J.E.P., Earth Reinforcement and Soil Structure, Butterworths, 1985.
4. Koerner, R.M. and Welsh, J.P., Construction and Geotechnical Engineering using Synthetic Fabrics, John Wiley, 1990.

Reference Books:

1. Moseley, M.D., Ground Treatment, Blackie Academic and Professional, 1998.
2. Hehn, R.W., Practical Guide to Grouting of Underground Structures, ASCE, 1996.
3. Koerner, R.M., Designing with Geosynthetics (Third Edition), Prentice Hall, 1997.

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KADAPA - 516 003. (A.P.)

M. Tech., I Semester

Course Title	Pavement Analysis and Design				M. Tech. I Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
1851105	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs					End Exam Duration : 3 Hrs			

Course Objectives:

- To understand the different types of pavements.
- To conduct analysis of flexible pavements for stresses, strains, and deflections in one-, two-, and three-layered systems.
- To design flexible pavements using the AASHTO design procedure.
- To conduct analysis of rigid pavements for stresses, strains, and deflections.
- To design rigid pavements using the AASHTO design procedure.

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

CO 1	The students will be able to design flexible as well rigid pavements

UNIT - I

Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements

UNIT - II

Stresses and strains in flexible pavements: Stresses and strains in an infinite elastic half space use of Boussinesq's equations - Burmister's two layer and three layer theories; Wheel load stresses, various factors in traffic wheel loads; Equivalent single wheel load of multiple wheels. Repeated loads and EWL factors

UNIT –III

Flexible pavement design methods for highways and airports: Empirical, semi-empirical and theoretical approaches; Development, principle, design steps of the different pavement design methods including AASHTO, Asphalt Institute, Shell Methods. IRC method of pavement design

UNIT –IV

Stresses in rigid pavements: Types of stresses and causes; Introduction to Westergaard's equations for calculation of stresses in rigid pavement due to the influence of traffic and temperature; Considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.

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K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –V

Rigid pavement design: Design of cement concrete pavement for highways and runways; Design of joints, reinforcements, tie bars, dowel bars. IRC method of design; Design of continuously reinforced concrete pavements

Text Books:

1. Yang H Huang - Pavement Analysis and Design, 2nd Edition, Pearson Education
2. KhannaS.K & Justo C.E.G – Highway Engineering, Khanna Publishers.
3. Srinivasa Kumar R – Pavement design, University press (India) Pvt. Ltd 2013

Reference Books:

1. Design and Specification of Rural Roads (Manual), Ministry of Rural Roads, Government of India, New Delhi, 2001
2. Yoder R.J And Witchakm.W., Principles of Pavement Design, John Wiley, 2000.
3. Guidelines for the Design of Flexible Pavements, IRC: 37 - 2001, the Indian Roads Congress, New Delhi.
4. Guideline for the Design of Rigid Pavements for Highways, IRC: 58-1998, the Indian Roads Congress, New Delhi.

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(Autonomous)
KADAPA - 516 003. (A.P.)

M. Tech., I Semester

Course Title	FEM in Geo-Mechanics					M. Tech. I Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851106	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- To explain the basic concepts of FEM
- To explain the principles and formulation of variational methods
- To analyse the displacements and explain the problems in soils and rocks
- To explain the applications of FEM in geotechnical engineeirng

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

CO 1	Students can understand basic stress-strain relationship for soil and develop Stress deformation analysis.
CO 2	Students can develop finite element formulation for different geotechnical problems including shallow foundation, seepage and consolidation problems.

UNIT - I

Basic Concepts: Basic concepts - Discretization of continuum, typical elements, the element characteristic matrix, Element assembly and solution for unknowns - Applications.

UNIT - II

Variational Principles: Variational principles, variational formulation of boundary value problems, Variational methods approximation such as Ritz and weighted residual (Galerkin) methods, Applications.

UNIT –III

Displacements Based Elements: Displacements based elements, finite elements for axial symmetry. One-dimensional problems of stress, deformation and flow, Assembly, Convergence requirements, Finite elements analysis of two-dimensional problems. The linear and quadratic triangle, Natural coordinates.

UNIT –IV

Iso-parametric Formulation: Application of FEM to Problems in soils and rocks, Introduction to non-linearity, Finite difference method, Description and application to consolidation, seepage, Winkler foundation etc.,

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –V

Applications in Geotechnical Engineering: Application of FEM to Problems in soils, Introduction to non-linearity, Finite difference method, Description and application to consolidation, seepage, Winkler foundations

Text Books:

1. Reddy, J.N., An Introduction to the Finite Element Method, McGraw Hill, 1984.
2. Tirupathi R. Chandrupatla and Ashok D. Belegundu., Introduction to Finite Elements in Engineering, Prentice- Hall, 1991.
3. Rajasekaran, S., Finite Element Analysis in Engineering Design, Wheller Publishing, Allahabad, 1993.
4. Smith, I.M., Programming the Finite Element Method with Application to Geomechanics, John Wiley and sons, New Delhi, 2000.

Reference Books:

1. Cook, R.D., Malkus, D.S., and Plesha, M.E., Concepts and Applications of Finite Element Analysis, John Wiley, 1989.
2. Gupta, O.P. Finite and Boundary Element Methods in Engineering, Oxford & IBH Publishing Co., Pvt. Ltd., New Delhi, 2000.
3. Potts, D.M. and Zdramcovic, L., Finite Element analysis in Geotechnical Engineering - Application, Thomas Telford, 2001.

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KADAPA - 516 003. (A.P.)

M. Tech., I Semester

Course Title	Environmental Geo-Technology					M. Tech. I Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851107	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- To learn concepts of geo-environmental engineering, and planning and design of waste in landfills, ash ponds and tailing ponds.
- Explain the effects of pollutants in soil properties
- Awareness about the adverse effects of soil and ground water contaminants
- Analyse and apply the various techniques for remediation of the contaminants

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

CO 1	Students can understand Soil-environment interaction, Soil mineralogy and Mechanisms of soil-water interaction
CO 2	Students can lean ground water flow and predict contaminant transport phenomenon. Can apply remediation techniques for contaminated site.

UNIT - I

Introduction: Industrialization and Urbanization, Pollution, Control and remediation.

Contamination: Surface contamination, Contamination transport, Soil-a Geotechnical trap, Effect of subsurface contamination, Detection of polluted zone, Monitoring and Effectiveness of designed facilities.

UNIT - II

Contaminants of Solid Waste in Landfills: Waste contaminants, landfills, types, shape and size of landfills. Liner and liner system, Cover and cover system, Stability of landfills. Landfill construction & operation, sustainable waste management.

UNIT –III

Contaminants of Slurry wastes: Slurry transported wastes, slurry ponds, operation, Embankment construction and raising, Design aspects, Environmental Impact and control.

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –IV

Vertical Barriers for Contaminant: Contaminated sites, Types of barriers, Soil-Bentonite slurry trench walls, Cement-Bentonite slurry trench walls, construction, material and design aspects.

UNIT –V

Geotechnical Reuse of Waste materials: Waste reduction, use in geotechnical construction, waste characteristics, transportation consideration, Engineering properties of Wastes, Waste material in Embankment and Fills.

Text Books:

1. Geo-environmental Engineering by Sharma H.D & Reddy K.R
2. Geo-environmental Engineering by ReddiL.N & Inyang.H.I
3. Geo Technical Practice for Waste Disposal by Daniel.D.EWentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.
4. Fried, J.J., Ground Water Pollution, Elsevier, 1975.

Reference Books:

1. Geotechnical Geo – Environmental Engineering hand Book – Kerry Row
2. Ground Water Contamination: Bedient, Refai & Newell.
3. Daniel, B.E., Geotechnical Practice for waste disposal, Chapman and Hall, London, 1993.
4. Proceedings of the International symposium of Environmental Geo-technology (Vol.I and II), Environmental Publishing Company, 1986 and 1989.
5. ASTM Special Technical Publication 874, Hydraulic Barrier in Soil and Rock, 1985.

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KADAPA - 516 003. (A.P.)

M. Tech., I Semester

Course Title	Critical Soil Mechanics					M. Tech. I Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851108	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- To demonstrate basic mechanisms behind index properties and tests on soil, relate behaviour of soils subjected to various loading and drainage conditions within unified framework of Critical state soil mechanics.
- To analyse theory of elasticity and plasticity to characterize the stress – strain behaviour of soils and to formulate basic elasto-plastic model based on Critical State Soil Mechanics (CSSM) like Cam-clay

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

CO 1	At the completion of the course the students will be able to decide the type of mathematical models to be used for analyzing the behavior of soil mass at critical state

UNIT - I

Soil Behavior: State of Stress and Strain in Soils, Stress and Strain Paths and Invariants, Behavior of Soils under Different Laboratory Experiments

UNIT - II

The Critical State Line and the Roscoe Surface: Families of Undrained Tests, Families of Drained Tests, The Critical State Line, Drained and Undrained Surfaces, The Roscoe Surface

UNIT –III

Behavior of Overconsolidated Samples: The Hvorslev Surface: Behaviour of Overconsolidated Samples, Drained and Undrained Tests, The Hvorslev Surface, Complete State Boundary Surface, Volume Changes and Pore Water Pressure Changes

UNIT –IV

Behaviour of Sands: The Critical State Line for Sands, Normalized Plots, The Effect of Dilation, Consequences of Taylor's Model

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –V

Behaviour of Soils before Failure: Elastic and Plastic Deformations, Plasticity Theory, Development of Elastic-Plastic Model Based on Critical State Soil Mechanics, The Cam-Clay Model, The Modified Cam-Clay Model

Text Books:

1. J. H. Atkinson and P. L. Bransby, "The Mechanics of Soils: An Introduction to Critical State Soil Mechanics", Mcgraw Hill, 1978

Reference Books:

1. D. M. Wood, "Soil Behaviour and Critical State Soil Mechanics", Cambridge University Press, 1990
2. B. M. Das, "Fundamental of Geotechnical Engineering", Cengage Learning, 2013

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KADAPA - 516 003. (A.P.)

M. Tech., I Semester

Course Title	Research Methodology and IPR				M. Tech. I Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1851109	Open Elective (MLC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	0	0	2	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

UNIT - I

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

UNIT - II

Effective literature studies approaches, analysis Plagiarism, Research ethics

UNIT –III

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

UNIT –IV

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

UNIT –V

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

Reference Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.

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KADAPA - 516 003. (A.P.)

6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

M. Tech., I Semester

<table>
<tr><td>Course Title</td><td colspan="5">Soil Mechanics – 1 Laboratory</td><td colspan="3">M. Tech. I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1851110</td><td rowspan="2">Professional Core (PCC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td><td>80</td><td>50</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: ----</td><td colspan="3">End Exam Duration : 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To estimate index properties of soils (coarse and fine),
• To estimate consistency limit of fine grained soils,</td></tr>
<tr><td colspan="9">On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Classify soil by physical observation of the soils,</td></tr>
<tr><td>CO 2</td><td colspan="8">Carry out interpolation among the estimated soil design parameters</td></tr>
</table>

List of Experiments:

1. Determination of Moisture Content and Specific Gravity of Soil
2. Grain Size Distribution Analysis and Hydrometer Analysis
3. Atterberg Limits (Liquid Limit, Plastic Limit, Shrinkage Limit)
4. Visual Classification Tests
5. Vibration Test for Relative Density of Sand
6. Standard and Modified Proctor Compaction Test
7. Falling Head Permeability Test and Constant Head Permeability Test
8. Consolidation Test

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(Autonomous)
KADAPA - 516 003. (A.P.)

M. Tech., I Semester

Course Title	Soil Mechanics – 2 Laboratory					M. Tech. I Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851111	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	4	2	50	50	100
Mid Exam Duration: ----						End Exam Duration : 3 Hrs		

Course Objectives:

- To estimate shear strength of soils by direct shear test and unconfined compressive test
- To estimate the engineering properties of the soils by density test, CBR, permeability test

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

CO 1	Classify soil based on estimated engineering characteristics of soils
CO 2	Carry out interpolation among the estimated soil design parameters

List of Experiments:

1. Unconfined Compression Test
2. Direct Shear Test
3. Tri-Axial Compression Test – UU, CU, CD Tests
4. Laboratory Vane Shear Test
5. Field Vane Shear Test
6. Field Direct Shear Test

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(Autonomous)
KADAPA - 516 003. (A.P.)

II Semester
Syllabus

M. Tech., II Semester

Course Title	Dynamics of Soil and Foundations				M. Tech. II Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
1851201	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs					End Exam Duration : 3 Hrs		

Course Objectives:

- To study vibration concepts in soils like damping, wave propagation, resonance and effect of modes of vibrations
- To study dynamic soil properties. Determination of dynamic properties by field and laboratory tests
- Effect of liquefaction and antiliquifaction measures
- To study vibration isolation, machine foundation design

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

CO 1	Students understand theory of vibration and resonance phenomenon, dynamic amplification.
CO 2	Students understand propagation of body waves and surface waves through soil.
CO 3	Student exposed to different methods for estimation of dynamic soil properties required for design purpose.
CO 4	Students can predict dynamic bearing capacity and assess liquefaction potential of any site.
CO 5	Students apply theory of vibrations to design machine foundation based on dynamic soil properties and bearing capacity.

UNIT – I

Fundamentals of Vibration: Definitions, Simple harmonic motion, Response of SDOF systems of Free and Forced vibrations with and without viscous damping, Frequency dependent excitation, Systems under transient loads, Rayleigh's method of fundamental frequency, Logarithmic decrement, Determination of viscous damping, Transmissibility, Systems with Two and Multiple degrees of freedom, Vibration measuring instruments -

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(Autonomous)
KADAPA - 516 003. (A.P.)

Types of damping - Equivalent stiffness of springs in series and parallel - Principles of vibration measuring devices

UNIT - II

Wave Propagation and Dynamic Soil Properties: Propagation of seismic waves in soil deposits - Attenuation of stress waves, Stress-strain behaviour of cyclically loaded soils, Strength of cyclically loaded soils, Dynamic soil properties - Laboratory and field testing techniques, Elastic constants of soils, Correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand. Liquefaction of soils: An introduction and evaluation using simple methods.

UNIT –III

Vibration Analyses: Types, General Requirements, Permissible amplitude, Allowable soil pressure, Modes of vibration of a rigid foundation block, Methods of analysis, Lumped Mass models, elastic half space method, elasto-dynamics, effect of footing shape on vibratory response, dynamic response of embedded block foundation, Vibration isolation.

UNIT –IV

Design of Machine Foundations: Analysis and design of block foundations for reciprocating engines, Dynamic analysis and design procedure for a hammer foundation, IS code of practice design procedure for foundations of reciprocating and impact type machines. Vibration isolation and absorption techniques.

UNIT –V

Machine Foundations on Piles: Introduction, Analysis of piles under vertical vibrations, Analysis of piles under translation and rocking, Analysis of piles under torsion, Design procedure for a pile supported machine foundation.

Text Books:

1. Swami Saran - Soil Dynamics and Machine Foundation, Galgotia Publications Pvt. Ltd. (2010)
2. Prakash, S. - Soil Dynamics, McGraw Hill Book Company (1981)

Reference Books:

1. I.Chowdhary and S P Dasgupta - Dynamics of Structures and Foundation, 2009.
2. Prakash, S. and Puri, V. K. - Foundation for Machines: Analysis and Design, John Wiley & Sons, 1998.
3. KameswaraRao, N. S. V. - Vibration Analysis and Foundation Dynamics, Wheeler Publication Ltd., 1998.
4. Das, B. M. - Principles of Soil Dynamics, PWS KENT publishing Company, Boston.2002

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K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

M. Tech., II Semester

Course Title	Subsurface Investigations and Instrumentation				M. Tech. II Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
1851202	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs					End Exam Duration : 3 Hrs			

Course Objectives:

- To identify the soil type of soil from a job site or in a professional setting, determine that soil's properties based on type and evaluate design decisions from your understanding of that soil's properties.
- To explore the scientific principles used to describe the major engineering properties of soil, and the engineering testing methods used to quantify these properties

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

CO 1	Students can plan subsurface investigation based on the requirement of civil engineering project and site condition. Can finalize depth and number of boreholes
CO 2	Students can execute different subsurface exploration tests, collect disturbed/undisturbed samples for laboratory tests and can suggest design parameters.
CO 3	Student exposed to different methods for estimation of dynamic soil properties required for design purpose.
CO 4	Students can develop instrumentation scheme for monitoring of critical sites

UNIT - I

General: Scopes and objectives of explorations – Planning a subsurface exploration – Stages in sub surface exploration – Explorations for preliminary and detailed design – Spacing and depth of exploration

UNIT - II

Open Excavation and Borings of Exploration: Pits and Trenches – Drifts and Shafts – Methods of boring – Auger Borings – Wash Borings –Rotary Drilling –Percussion Drilling – Core Drilling

Department of Civil Engineering
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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –III

Soil Samples and Samplers: Types of soil samples – Disturbed samples –Undisturbed samples – Design features affecting the sample disturbance –Split spoon samplers – Scraper Bucket Samplers –Shell by Tubes and Thin walled Samplers – Piston Samplers – Denis Samplers – Preservation and handling of samples

UNIT –IV

In-Situ Testing: Field tests – Standard Penetration Tests – Cone Penetration Tests – In-situ Vane Shear Test– Plate Load Test, monotonic and cyclic –Field Permeability Tests – In-situ Tests using Pressure meter – Observation of Ground Water Table– Instrumentation in soil engineering, strain gauges, resistance and inductance type

UNIT –V

Geophysical Methods: Types–Electrical Resistivity Methods – Electrical Profiling Method – Electrical Sounding Method – Seismic Methods – Seismic refraction method – Sub-soil Investigation Report

Mechanical Wave Measurements: Crosshole Tests (CHT), Downhole Tests (DHT), Spectral Analysis of Surface Waves, Seismic Refraction, Suspension Logging::Electromagnetic Wave Techniques: Ground Penetrating Radar (GPR), Electromagnetic Conductivity (EM), Surface Resistivity (SR), Magnetometer Surveys (MT)

Text Books:

1. V.N.S. Murthy, Soil Mechanics & Foundation Engineering, Vol. 2, Sai Kripa Technical Consultants, Bangalore
2. C. Venkataramaiah, Geotechnical Engineering, Wiley Eastern Ltd., New Delhi

Reference Books:

1. Hvorslev, MJ, Sub Surface Exploration and Sampling of Soils for Civil Engineering Purpose, Water-ways Station, Vicksburg, Mississippi, 1949.
2. Noel Simons, Bruce Menzies and Marcus Matthews, A Short Course in geotechnical Site Investigation, Thomas Telford.
3. SP36- Compendium of Indian Standards on Soil Engineering - Part –II
4. Dobrine, Geophysical methods

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KADAPA - 516 003. (A.P.)

M. Tech., II Semester

Course Title	Offshore Geo-Technical Engineering				M. Tech. II Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1851203	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- To analyze distribution of marine sediments along the Indian coasts.
- To analyze geotechnical challenges in case of marine sediments
- To implement in-situ testing procedures for determining the properties of marine clays.
- To analyze behavior of marine soil deposits under repetitive loading conditions.

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

CO 1	Students can execute investigation program for marine soil deposits and select necessary design parameters. Design suitable marine foundation as per project requirement. Can develop numerical model for response of marine foundation for offshore conditions.

UNIT - I

Marine Soil Deposits: Offshore Environment, Offshore Structures and Foundations, Specific Problems Related to Marine Soil Deposits, Physical and Engineering Properties of Marine Soils

UNIT - II

Behavior of Soils Subjected to Repeated Loading: Effect of Wave Loading on Offshore Foundations, Behavior of Sands and Clays Under Cyclic Loading, Laboratory Experiments Including Repeated Loading, Cyclic Behavior of Soils Based on Fundamental Theory of Mechanics, Approximate Engineering Methods which can be used for Practical Cases

UNIT –III

Site Investigation in the Case of Marine Soil Deposits: Challenges of Site Investigation in Marine Environment, Different Site Investigation Techniques, Sampling Techniques, Geophysical Methods, Recent Advancements in Site Investigation and Sampling used for Marine Soil Deposits

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KADAPA - 516 003. (A.P.)

UNIT –IV

Foundations in Marine Soil Deposits: Different Offshore and Nearshore Foundations, Gravity Platforms, Jack-Up Rigs, Pile Foundations. Cassions, Spudcans

UNIT –V

Numerical Modeling of Marine Foundations Subjected to Wave Loading: Numerical Modeling of Cyclic Behavior of Soils, Empirical Models, Elastic-Plastic Models, Fem Analysis of Marine Foundations Subjected to Wave Loading

Text Books:

1. H. G. Poulos. "Marine Geotechnics", Unwin Hyman Ltd, London, UK, 1988

Reference Books:

1. D. V. Reddy And M. Arockiasamy, "Offshore Structures", Volume: 1, R.E. Kreiger Pub And Co., 1991
2. D. Thomson And D. J. Beasley, "Handbook of Marine Geotechnical Engineering", US Navy, 2012

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KADAPA - 516 003. (A.P.)

M. Tech., II Semester

<table>
<tr><td>Course Title</td><td colspan="5">Computational Geo-Mechanics</td><td colspan="3">M. Tech. II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1851204</td><td rowspan="2">Professional Elective (PEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hrs</td><td colspan="3">End Exam Duration : 3 Hrs</td></tr>
<tr><td colspan="8">Course Objectives:
• To analyse linear and non-linear equations using numerical techniques.
• To apply finite difference and finite element method for analysing behaviour of geotechnical structures.
• To apply correlation and regression analysis for the geotechnical data.
• To solve problem of consolidation and flow through porous media using numerical technique.</td></tr>
<tr><td colspan="8">On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="7">Students can understand different numerical and statistical tools for analyzing various geotechnical engineering problems.</td></tr>
<tr><td>CO 2</td><td colspan="7">Students can apply probabilistic approach for selection of design parameters and compute their impact on risk assessment</td></tr>
</table>

UNIT - I

Solution of Non-Linear Equations: Bisection, False Position, Newton-Raphson, Successive Approximation Method, Iterative Methods

Solution of Linear Equations: Jacobi's Method, Gauss Seidal Method, Successive over Relaxation Method.

UNIT - II

Finite Difference Method: Two Point Boundary Value Problems – Disichlet Conditions, Neumann Conditions; Ordinary and Partial Differential Equations.

Finite Element Method: Fundamentals, Constitutive Finite Element Models for Soils.

UNIT –III

Correlation and Regression Analysis: Correlation - Scatter Diagram, Karl Pearson Coefficient of Correlation, Limits of Correlation Coefficient; Regression –Lines of Regression, Regression Curves, Regression Coefficient, Differences Between Correlation and Regression Analysis.

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –IV

One-Dimensional Consolidation - Theory of Consolidation, Analytical Procedures, Finite Difference Solution Procedure for Multilayered Systems, Finite Element Formulation

UNIT –V

Flow through Porous Media - Geotechnical Aspects, Numerical Methods, Applications and Design Analysis, Flow in Jointed Media.

Risk Assessment in Geotechnical Engg. - Probabilistic Site Characterisation and Design of Foundations

Text Books:

1. S. Chandrakant., Desai and John T. Christian, "Numerical Methods in Geotechnical Engineering", Mc. Graw Hill Book Company, 1977.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, "Numerical Methods for Scientific and Engineering Computations", Third Edition, New Age International (P) Ltd. Publishers, New Delhi.

Reference Books:

1. D.J. Naylor and G.N. Pande, "Finite Elements in Geotechnical Engineering", Pineridge Press Ltd., UK.
2. Sam Helwany, "Applied Soil Mechanics", John Wiley & Sons, Inc,

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(Autonomous)
KADAPA - 516 003. (A.P.)

M. Tech., II Semester

Course Title	Engineering Rock Mechanics				M. Tech. II Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
1851205	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs					End Exam Duration : 3 Hrs		

Course Objectives:

- To identify type of the rock, analyse the rock quality designation and also evaluate its strength, and to determine the methods of tunnelling and mining

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

CO 1	The students will be able to perform various laboratory tests on rock and classify rock mass. Be able to predict strength of rock mass with respect to various Civil Engineering applications

UNIT - I

Rock: Formation of Rocks, Physical Properties, Classification of Rocks and Rock Masses, Elastic Constants of Rock; In-situ Stresses in Rock

Rock Testing: Laboratory and Field Tests

UNIT - II

Discontinuities in Rock Masses: Discontinuity Orientation, Effect of Discontinuities on Strength of Rock

UNIT –III

Strength Behaviour: Compression, Tension and Shear, Stress-Strain Relationships, Rheological Behavior

UNIT –IV

Strength/ Failure Criterion: Mohr-Coulomb, Griffith Theory, Hoek and Brown, Strength and other Strength Criteria. Stresses in Rock near Underground Openings;

UNIT –V

Application of Rock Mechanics in Civil Engineering: Rock Tunneling, Rock Slope Stability, Bolting, Blasting, Grouting and Rock Foundation Design. Modern Modelling Techniques & Analyses in Rocks.

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KADAPA - 516 003. (A.P.)

Text Books:

1. Hudson J.A. and J.P. Harrison. Engineering Rock Mechanics: An Introduction to the Principles, 1997. Elsevier, Oxford
2. Goodman, R.E. Introduction to Rock Mechanics, John Wiley & Sons.
3. Ramamurthy, T., "Engineering in Rocks", Phi Learning Pvt. Ltd.

Reference Books:

1. Jaeger, J.C. and Cook, N.G.W, Fundamentals of Rock Mechanics, Chapman and Hall, 1976.
2. Wyllie, D.C., Foundations on Rock, E & Fn Spon. 2nd Edition, 1992.

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KADAPA - 516 003. (A.P.)

M. Tech., II Semester

Course Title	Earth Retaining Structures					M. Tech. II Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851206	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- To calculate earth pressure on various earth retaining structures such as gravity retaining walls, sheet pile, bulkheads, bracing/struts and coffer dams, design a relevant earth retaining structure for given soil condition, design of sheet pile with and without anchors, and to design the reinforced wall by using different materials

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

CO 1	The students will be able to do analysis and design of different types of retaining structures

UNIT - I

Earth Pressure Theories: Introduction – State of stress in retained soil mass – Earth pressure theories – Analytical and graphical techniques – Active and passive cases – Earth pressure due to homogeneous and layered backfills, uniform surcharge, uniformly sloping surcharge and randomly positioned surcharges, - Empirical methods – Wall movement and complex geometry

UNIT - II

Drainage and Stability Considerations: Lateral pressure due to compaction, strain softening, wall flexibility – influence of drainage – Earth pressure due to earthquake forces – Stability of retaining structures

UNIT –III

Sheet Pile Walls: Retaining structure – Selection of soil parameters – Analysis and design of cantilever and anchored sheet pile walls – Deadman and continuous anchors – Diaphragm and bored pile walls – Design requirements

Caissons: Types – Stability of caissons – principles of analysis and design – seismic influences - IRC Guidelines

UNIT –IV

Supported Excavations: Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving - Earth pressure around tunnel lining, shaft and silos

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KADAPA - 516 003. (A.P.)

UNIT –V

Design of Reinforced Earth Retaining Wall: Reinforced earth retaining wall – principles, Concepts and mechanism of reinforced Earth – Design consideration of reinforced earth – Materials used in reinforced earth - Geotextile – Geo-grids, Metal strips, facing elements.

Text Books:

1. Koerner, R.M., Design with Geosynthetics (Third Edition), Prentice Hall, 1997.
2. Das, B.M., Principles of Geotechnical Engineering (Fourth Edition). The PWS series in Civil Engineering, 1998
3. Mandal, J.N., Reinforced Soil and Geo-textiles, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. J E Bowles, Foundation Engineering to add this text book

Reference Books:

1. Winterkorn, H.F. and Fang, Y.F., Foundation Engineering Handbook, Van Nostrand Reinhold, 1994.
2. Day, R.W., Geotechnical and Foundation Engineering, Design and Construction, McGraw Hill 1999.
3. McCarthy, D.F., Essentials of Soil Mechanics and Foundations: Basic Geo-techniques (Sixth Edition), Prentice Hall, 2002.
4. Militisky, J. and Woods, R., Earth and Earth retaining structures, Routledge, 1992.

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KADAPA - 516 003. (A.P.)

M. Tech., II Semester

Course Title	Design of Underground Excavations					M. Tech. II Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851207	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- To know the planning and exploration of various underground projects, analyse the stress distribution, analyse the rock quality designation and also evaluate its strength
- To analyse the interaction between the rock mass and tunnel surface

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

CO 1	Students can understand the use of elastic and plastic analysis in the design of underground support system.
CO 2	Students will have idea about the field tests generally conducted during and after construction of under structures.

UNIT - I

Introduction, Planning and Exploration for Various Underground Construction Projects, Stereographic Projection Method, Principle and its Application in Underground Excavation Design.

UNIT - II

Elastic Stress Distribution around Tunnels, Stress Distribution for Different Shapes and Under Different In-Situ Stress Conditions, Greenspan Method, Design Principles, Multiple Openings, Openings in Laminated Rocks, Elasto-Plastic Analysis of Tunnels, Daemen's Theory

UNIT –III

Application of Rock Mass Classification Systems, Ground Conditions in Tunneling, Analysis of Underground Openings in Squeezing and Swelling Ground, Empirical Methods, Estimation of Elastic Modulus and Modulus of Deformation of Rocks; Uniaxial Jacking / Plate Jacking Tests, Radial Jacking and Goodman Jacking Tests, Long Term Behaviour of Tunnels and Caverns, New Austrian Tunneling Method (Natm), Norwegian Tunneling Method (Ntm), Construction Dewatering.

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –IV

Rock Mass-Tunnel Support Interaction Analysis, Ground Response and Support Reaction Curves, Ladanyi's elasto-Plastic Analysis of Tunnels, Design of Various Support Systems Including Concrete and Shotcrete Linings, Steel Sets, Rock Bolting and Rock Anchoring, Combined Support Systems, Estimation of Load Carrying Capacity of Rock Bolts

UNIT –V

In-Situ Stress, Flat Jack, Hydraulic Fracturing and Over Coring Techniques and USBM type Drill Hole Deformation Gauge, Single and Multi-Point Bore Hole Extensometers, Load Cells, Pressure Cells, etc. Instrumentation and Monitoring of Underground Excavations, During and After Construction, Various Case Studies

Text Books:

1. Hoek, E and Brown, E. T.," Underground Excavations in Rocks", Institute of Mining Engineering.
2. Obert, L. and Duvall, W.I., "Rock Mechanics and Design of Structures in Rocks", John Wiley.

Reference Books:

1. Singh, B. and Goel, R.K., "Rock Mass Classification - A Practical Engineering Approach", Elsevier.
2. Singh, B. and Goel, R.K., "Tunnelling in Weak Rocks", Elsevier

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M. Tech., II Semester

Course Title	Physical and Constitutive Modeling on Geo-Mechanics				M. Tech. II Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
1851208	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs					End Exam Duration : 3 Hrs		

Course Objectives:

- To understand the concept of linear, quasi linear concept, basics of plasticity in soils,
- To analyse theory of elasticity and plasticity to characterize the stress – strain behaviour of soils and to formulate basic elasto-plastic model based on Critical State Soil Mechanics (CSSM) like Cam-clay
- To understand the concept of consolidation, formulation and implementation of plasticity theory.

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

CO 1	Students can understand theory of plasticity and various yield criteria and flow rule.
CO 2	Students can apply critical state concept to consolidation and triaxial soil behavior.

UNIT - I

Role of Constitutive Modeling; Importance of Laboratory Testing with Relation to Constitutive Modeling; Elasticity: Linear, Quasi Linear, Anisotropic

UNIT - II

Plasticity Basics: Yield Criteria, Flow Rule, Plastic Potential, Hardening/Softening; Rate Independent Plasticity: Mohr-Coulomb, Nonlinear Failure Criteria, Drucker Prager, and Cap Models

UNIT –III

Critical State Soil Mechanics: Critical State Concept, Cam Clay Models, Simulation of Single Element Test Using Cam Clay

UNIT –IV

Consolidation, Drained and Undrained Triaxial Test; Stress Dilatancy Theory

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –V

Work Hardening Plasticity Theory: Formulation and Implementation; Applications of Elasto-Plastic Models; Special Topics: Hypoelasticity-Plasticity, Disturbed State Concept.

Text Books:

1. Hicher and Shao, "Constitutive Modeling of Soils and Rocks", John Wiley. 2008
2. C.S. Desai and H. J. Siriwardane, "Constitutive Laws for Engineering Materials with Emphasis on Geologic Materials", Prentice-Hall, Inc., New Jersey. 1984
3. David M Potts and Lidijazdravkovic, "Finite Element Analysis in Geotechnical Engineering Theory and Application", Thomas Telford. 1999

Reference Books:

1. C.S. Desai, "Mechanics of Materials and Interfaces: The Disturbed State Concept", CRC Press Ltd. 2000
2. A.P.S. Selvadurai, M.J. Boulon, "Mechanics of Geomaterial Interfaces, Elsevier.

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(Autonomous)
KADAPA - 516 003. (A.P.)

M. Tech., II Semester

Course Title	Sub Soil Exploration Laboratory				M. Tech. II Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
1851210	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	4	2	50	50	100
Mid Exam Duration: -----					End Exam Duration : 3 Hrs		
Course Objectives: • To estimate the load carrying capacity and soil profile							
On successful completion of this course, the students will be able to							
CO 1	Classify soil based on the collection of soil by borings						
CO 2	Design the suitable foundation based upon the load carrying capacity of the soil						
CO 3	Carry out interpolation among the estimated soil design parameters						

List of Experiments:

Exploratory Borings by Different Methods Including Auger Boring, Wash Boring, Percussion Drilling and Rotary Drilling.

1. Standard Penetration Test
2. Dynamic Cone Penetration Test
3. Static Cone Penetration Test
4. Plate Load Test
5. Pressure Meter Test
6. Geophysical Exploration Tests

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K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

M. Tech., II Semester

Course Title	Geo-Technical Engineering Modeling Laboratory					M. Tech. II Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851211	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	4	2	50	50	100
Mid Exam Duration: -----						End Exam Duration : 3 Hrs		
Course Objectives: • To estimate the safe slope, load carrying capacity								
On successful completion of this course, the students will be able to								
CO 1	Design suitable slope, pile for both static and dynamic conditions							

List of Experiments:

1. Slope Modeling
2. Sigma modelling
3. Quake modelling
4. Analysis of slope by Fellenius, Bishop and Janbu method
5. Boussinesq analysis for displacement due to loads
6. Mindlin analysis for displacement due to loads
7. Analysis of pile (capacity, end bearing, bearing capacity and settlement)
8. Analysis of one-dimensional soil column to an earthquake motion

Software:

1. GeoStudio
2. Oasys – Geo Suite

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KADAPA - 516 003. (A.P.)

III Semester
Syllabus

M. Tech., III Semester

Course Title	Stability Analysis of Slopes				M. Tech. III Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
1851301	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs					End Exam Duration : 3 Hrs			

Course Objectives:

- To introduce the concepts of slope stability, introduce the concepts of slope stability analyses using simplified methods, and to describe some of the sophisticated methods of slope stability analyses.

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

CO 1	Student will be able to check the stability of earthen dams, and the safety measures to be undertaken to prevent the instability of slopes, earthen dams and embankments

UNIT - I

Slopes: Types and Causes of Slope Failures, Mechanics of Slope Failure, Failure Modes.

UNIT - II

Stability Analysis: Infinite and Finite Slopes with or Without Water Pressures; Concept of Factor of Safety, Pore Pressure Coefficients, Mass Analysis, Wedge Methods, Friction Circle Method; Method of Slices, Bishop's Method, Janbu's Method, Morgenstern And Price, Spencer's Method

UNIT –III

Stability Analysis in the Presence of Seepage: Two Dimensional Flow – Laplace Equation and it's Solution, Graphical Method, Determination of Phreatic Line, Flow Nets in Homogeneous and Zoned Earth Dams under Steady Seepage and Draw-Down Conditions, Seepage Control in Earth Dams, Influence of Seepage on Slope Stability Stability Analysis of Dam Body During Steady Seepage

UNIT –IV

Strengthening Measures: Stabilization of Slopes by Drainage Methods, Surface and Subsurface Drainage, Use of Synthetic Filters, Retaining Walls, Stabilization and Strengthening of Slopes, Shotcreting, Rock Bolting and Rock Anchoring, Instrumentation and Monitoring of Slopes, Slope Movements, Warning Devices, Maintenance of Slopes

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –V

Case studies of urban slope stability: Aims, Regional perspective, Landslide inventory, Stability analyses of three sites, Case study 1 – Site 64 in the suburb of Scarborough, Case study 2 – Site 77, Morrison Avenue – Wombarra, Case study 3 – Site 134, Woonona Heights, Concluding remarks on the three case studies, Landslide-triggering rainfall, Landslide susceptibility and hazard, Observational approach and monitoring.

Text Books:

1. Chowdhary R Phil Flentje and Bhattacharya G, "Geotechnical Slope Analysis", CRC Press.
2. YM Cheng and CK lau, "Slope Stability Analysis and Stabilization", CRC Press.

Reference Books:

1. Harr M.E., "Ground Water and Seepage", McGraw Hill. 1962

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(Autonomous)
KADAPA - 516 003. (A.P.)

M. Tech., III Semester

Course Title	Foundation on Weak Rocks				M. Tech. III Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1851302	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- To study the properties of weak rock and classification, analyse the effect of structural planes, study the requirements of satisfactory performance of foundation and analyse the pile on weak rock

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

CO 1	The students will be able to classify different types of rock mass and design different types of foundations placed over rock mass.

UNIT - I

Engineering Properties of Weak Rocks, Different Rock Mass Classification Systems, Relative Merits and Demerits, Failure Criteria for Weak Rocks, Bi-Linear Mohr-Coulomb Failure Criterion, Hoek and Brown Criterion and Modified Hoek and Brown Failure Criterion Etc.

UNIT - II

Effect of Structural Planes on Rock Foundations, Possible Modes of Failure of Foundations on Rocks/ Rock Masses, Determination of In-Situ Shear Strength of Rocks and Rock Masses

UNIT –III

Requirements for Satisfactory Performance of Foundations, Bearing Capacity of Foundations on Rocks and Rock Masses, Allowable Bearing Pressure of Rock Foundations Using a Nonlinear Failure Criterion, Monotonic and Cyclic Plate Load Tests, Pressure-Settlement Characteristics, Effect of Layering, Anisotropy, Heterogeneity and Inelasticity

UNIT –IV

Shallow Foundations, Shallow Foundations on Sloping Ground, Raft Foundations, Stilt Foundations, Foundations for Suspension Bridges, Transmission Line Towers, Framed Buildings etc, Treatment of Foundations - Open Joints, Solution Cavities, Weak Seams

Head
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K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –V

Piles in Weak Rocks, Bearing Capacity and Settlement of Piles, Piles in Stratified Rock Masses, Field Load Tests on Piles in Weak Rocks, Behaviour of Bored / Driven Piles in Soft / Weathered Rocks

Text Books:

1. Singh, B. and Goel, R.K., "Rock Mass Classification- A Practical Engineering Approach", Elsevier.
2. Ramamurthy, T., "Engineering In Rocks", PHI Learning Pvt. Ltd.
3. Hoek, E., "Practical Rock Engineering", Rock Science.

Reference Books:

1. Wyllie Duncan C.," Foundations on Rock: Engineering Practice", E & Fn Spon, Taylor And Francis.
2. Hudson J.A. and J.P. Harrison. Engineering Rock Mechanics: An Introduction to the Principles, 1997. Elsevier, Oxford

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KADAPA - 516 003. (A.P.)

M. Tech., III Semester

Course Title	Geo-Technical Earthquake Engineering					M. Tech. III Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851303	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- To determine size of earthquake and strong ground motion parameters from a recorded seismogram or accelerogram.
- To analyse deterministic or probabilistic seismic hazard analysis considering the different soil properties and site conditions
- To study principles of wave propagation through rocks and soil media to derive transfer functions for ground response analysis.
- To analyze liquefaction susceptibility of a site and determine factor of safety against liquefaction.
- To design earthquake resistant geotechnical structures like shallow and deep foundations, retaining walls, slopes

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

CO 1	Students will know the causes and quantification of earthquake.
CO 2	Student will be exposed to the effect of earthquake and the design criterions to be followed for the design different geotechnical structures

UNIT - I

Elements of Earthquake Seismology and Dynamics: Theory of vibration - Basic Definition - Governing equation for single degree freedom system - Forced vibrations - Rotating mass type excitation - Base excitation - Isolation vibration measuring instruments. Mechanism of Earthquakes - Causes of earthquake - Earthquake Fault sources - Elastic Rebound theory - Seismic wave in Earthquake shaking - Definition of earthquake terms - Locating an earthquake - Quantification of earthquakes.

UNIT - II

Ground Motion Characteristics: Strong Motion Records -characteristics of ground motion - Factors influencing ground motion - Estimation of frequency content parameters - (Seismic site investigations - Evaluation of Dynamic soil properties

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(Autonomous)
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UNIT –III

Ground Response Analysis - Local Site Effects and Design Ground Motion: Wave propagation Analysis - Site Amplification Need for Ground Response Analysis - Method of analysis - One Dimensional Analysis - Equipment linear Analysis site effects - Design Ground Motion - Developing Design Ground Motion

UNIT –IV

Seismic Stability Analysis: Earthquake - Resistant Design of foundation of buildings - Design considerations - Geotechnical - Architectural - Structures - Capacity Design - Seismic analysis. Earthquake Response of slopes - Evaluation of slope stability - Pseudostatic Analysis - Newmark's Study of Block Analysis - Dynamic Analysis - Earth pressure due to ground shaking Evaluation, Liquefaction-Susceptibility-Evaluation Cyclic stress approach - Liquefaction Resistance - Laboratory and Field Tests with interpretation - Lateral Deformation - Case Study

UNIT –V

Earthquake Hazard Mitigation: Seismic risk vulnerability and hazard - Percept of risk - risk mapping - scale - hazard assessment - Maintenance and modifications to improve hazard resistance - Different type of foundation and its impact on safety - Ground Improvement Techniques.

Text Books:

1. Kameswara Rao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing - New Delhi, 2000.
2. Krammer S.L., Geotechnical Earthquake Engineering, Prentice Hall, International Series, Pearson Education (Singapore) Pvt. Ltd., 2004.
3. Kameswara Rao, Vibration Analysis and Foundation Dynamics, Wheeler Publishing, New Delhi, 1998.

Reference Books:

1. Shamsher Prakash and Vijay Kumar Puri., Foundations for Machines, John Wiley and Sons, New Delhi, 1988
2. "Earth Quake" W.H. Freeman, New York.

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KADAPA - 516 003. (A.P.)

M. Tech., III Semester

Course Title	Business Analytics					M. Tech. III Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851304	Open Elective (OEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data. Use decision-making tools/Operations research techniques. Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

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

CO 1	Students will demonstrate knowledge of data analytics.
CO 2	Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
CO 3	Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
CO 4	Students will demonstrate the ability to translate data into clear, actionable insights.

UNIT – I

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT - II

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT –III

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT –IV

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT –V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Reference Books:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

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KADAPA - 516 003. (A.P.)

M. Tech., III Semester

Course Title	Industrial Safety					M. Tech. III Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851305	Open Elective (OEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

UNIT - I

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

UNIT - II

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

UNIT –III

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods

UNIT –IV

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, Electrical motors, Types of faults in machine tools and their general causes

UNIT –V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its

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Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG)sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

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KADAPA - 516 003. (A.P.)

M. Tech., III Semester

Course Title	Operation Research					M. Tech. III Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851306	Open Elective (OEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

UNIT - I

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT - II

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT –III

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT –IV

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT –V

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Reference Books:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

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M. Tech., III Semester

Course Title	Cost Management of Engineering Projects					M. Tech. III Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851307	Open Elective (OEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

UNIT - I

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT - II

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT –III

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.

UNIT –IV

Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT –V

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

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Reference Books:

1. Cost Accounting a Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

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KADAPA - 516 003. (A.P.)

M. Tech., III Semester

Course Title	Composite Materials					M. Tech. III Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851308	Open Elective (OEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

UNIT - I

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT - II

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT –III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT –IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT –V

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Text Books:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.

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2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

Reference Books:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

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KADAPA - 516 003. (A.P.)

M. Tech., III Semester

Course Title	Waste to Energy					M. Tech. III Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1851309	Open Elective (OEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

UNIT - I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT - II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT –III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT –IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT –V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion -Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Reference Books:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996

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Audit Course
Syllabus

M. Tech.

Course Title	English For Research Paper Writing				M. Tech.		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1870A01	Audit (AC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	0	0	40	---	40
Mid Exam Duration: 2 Hrs						End Exam Duration : ----		

UNIT - I

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

UNIT - II

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

UNIT –III

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

UNIT –IV

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

UNIT –V

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT –VI

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Text Books & Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's Book.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

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KADAPA - 516 003. (A.P.)

M. Tech.

Course Title	Disaster Management					M. Tech.		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1870A02	Audit (AC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	0	0	40	---	40
Mid Exam Duration: 2 Hrs						End Exam Duration : ----		

UNIT - I

Introduction:

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

UNIT - II

Repercussions of Disasters and Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem.

Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT –III

Disaster Prone Areas In India: Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

UNIT –IV

Disaster Preparedness and Management:

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT –V

Risk Assessment:

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's. Participation In Risk Assessment. Strategies for Survival.

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –VI

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

Text Books & Reference Books:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.

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KADAPA - 516 003. (A.P.)

M. Tech.

Course Title	Sanskrit For Technical Knowledge				M. Tech.		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1870A03	Audit (AC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	0	0	40	---	40
Mid Exam Duration: 2 Hrs						End Exam Duration : ----		

UNIT - I

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

UNIT - II

Order, Introduction of roots, Technical information about Sanskrit Literature

UNIT –III

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Text Books & Reference Books:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

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KADAPA - 516 003. (A.P.)

M. Tech.

Course Title	Value Education				M. Tech.		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1870A04	Audit (AC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	0	0	40	---	40
Mid Exam Duration: 2 Hrs						End Exam Duration : ----		

Course Objectives:

Students will be able to

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

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

CO 1	Knowledge of self-development
CO 2	Learn the importance of Human values
CO 3	Developing the overall personality

UNIT - I

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

UNIT - II

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

UNIT –III

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

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(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –IV

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

Text Books & Reference Books:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

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(Autonomous)
KADAPA - 516 003. (A.P.)

M. Tech.

Course Title	Constitution of India				M. Tech.		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1870A05	Audit (AC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	0	0	40	---	40
Mid Exam Duration: 2 Hrs						End Exam Duration : ----		

Course Objectives:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik
- Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

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

CO 1	Discuss the growth of the demand for civil right s in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO 2	Discuss the intellectual origins of the frame work of argument that informed the conceptualization of social reforms leading to revolution in India.
CO 3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO 4	Discuss the passage of the Hindu Code Bill of 1956.

UNIT - I

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working)

Philosophy of the Indian Constitution: Preamble Salient Features

UNIT - II

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational

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(Autonomous)
KADAPA - 516 003. (A.P.)

Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT –III

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT –IV

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT –V

Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books & Reference Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

M. Tech.

Course Title	Pedagogy Studies					M. Tech.		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1870A06	Audit (AC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	0	0	40	---	40
Mid Exam Duration: 2 Hrs						End Exam Duration : ----		

Course Objectives:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

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

CO 1	What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
CO 2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
CO 3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT - I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and Searching.

UNIT - II

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.

UNIT –III

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?, Theory of change, Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies.

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

UNIT –IV

Professional development: alignment with classroom practices and follow- up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT –V

Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Text Books & Reference Books:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

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KADAPA - 516 003. (A.P.)

M. Tech.

Course Title	Stress Management By Yoga				M. Tech.		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1870A07	Audit (AC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	0	0	40	---	40
Mid Exam Duration: 2 Hrs						End Exam Duration : ----		

Course Objectives:

- To achieve overall health of body and mind
- To overcome stress

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

CO 1	Develop healthy mind in a healthy body thus improving social health also Improve efficiency

UNIT - I

Definitions of Eight parts of yog. (Ashtanga)

UNIT - II

Yam and niyam.

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT –III

Asan and Pranayam

i) Various yog poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects-Types of pranayam

Text Books & Reference Books:

1. "Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda,
3. Advaitashrama (Publication Department), Kolkata

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K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

M. Tech.

Course Title	Personality Development Through Life Enlightenment Skills				M. Tech.		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1870A08	Audit (AC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	0	0	40	---	40
Mid Exam Duration: 2 Hrs						End Exam Duration : ----		

Course Objectives:

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

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

CO 1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
CO 2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity
CO 3	Study of Neetishatakam will help in developing versatile personality of students.

UNIT - I

Neetisatakam-Holistic development of personality: Verses- 19,20,21,22 (wisdom), Verses-29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's), Verses-71,73,75,78 (do's)

UNIT - II

Approach to day to day work and duties: Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48; Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35; Chapter 18-Verses 45, 46, 48.

UNIT –III

Statements of basic knowledge: Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68; Chapter 12 -Verses 13, 14, 15, 16,17, 18; Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42; Chapter 4-Verses 18, 38,39; Chapter18 – Verses 37,38,63.

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Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

Text Books & Reference Books:

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

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(Autonomous)
KADAPA - 516 003. (A.P.)

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Department of Civil Engineering

The list of the value added/certificate courses conducted in the Civil Engineering Department during the AY 2018-19.

S. No.	Semester	Value Added Course
1	VII	Value added course on Computer aided Steel Structures
2	V	Value added course on 3ds max
3	VII	Value added course on Building information modelling
4	IV	Value added course on Importance of software in civil engineering construction
5	VI	Value added course on Revit architecture

Convener/HOD

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

Syllabus of Value Added Course

Course Name: 3DS Max

Course Objectives:

- To navigate the software's interface and workspace efficiently, use basic modeling tools, and organize their projects effectively
- To develop 3D objects and scenes using polygonal, spline, and subdivision modeling techniques.
- To utilize the material editor to create and apply textures, maps, and shaders to 3D objects for realistic rendering.
- To implement various lighting techniques and optimize rendering settings for high-quality output.
- To create animations with keyframes, controllers, and rigging tools, and render animations for presentations or export to video formats

Course Outcomes: Upon completing the course students will be able to:

- Create 3D models and scenes using 3DS Max, demonstrating proficiency in modeling techniques.
- Apply materials, textures, and shaders effectively to create visually appealing 3D renderings.
- Set up lighting and rendering configurations to produce high-quality still images and animations.
- Animate objects and characters, showcasing their understanding of keyframe animation and rigging.
- Simulate special effects and dynamics to enhance the realism of 3D projects.

Contents

Module 1:

Introduction to 3DS Max: Overview of 3DS Max interface and workspace, Navigation and viewport controls, Basic modeling tools: creating and modifying primitive objects Saving and organizing projects.

Module 2:

3D Modeling: Polygon modeling techniques, Editable poly and editable spline objects, Subdivision surfaces, Applying modifiers for complex shapes, UV mapping and texture coordinates

Module 3:

Materials and Texturing: Material editor and shader types, Applying textures and maps, UV unwrapping and texture painting, Creating realistic materials, Material libraries and presets.

Module 4:

Lighting and Rendering: Types of lights in 3DS Max, Setting up a 3-point lighting system, Global Illumination and Ambient Occlusion, Rendering settings and output formats, Rendering still images and animations.

Module 5:

Animation: Keyframe animation, Animation controllers and curves, Character rigging basics, Animation constraints and expressions, Rendering animations and exporting to video formats.

Textbooks:

1. "3ds Max 2017 Bible" by Kelly L. Murdock
2. "3ds Max 2016 Essentials" by Randi L. Derakhshani and Dariush Derakhshani
3. "Mastering Autodesk 3ds Max 2015" by Jeffrey Harper

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

Syllabus of Value Added Course

Course Name: Building information modelling

Course Objectives:

- Define key BIM terminology and explain its significance in the construction industry.
- Demonstrate proficiency in using BIM software to create 3D models of buildings.
- Identify clashes and conflicts in BIM models and propose solutions for resolution.
- Utilize BIM data for construction planning, scheduling, and budgeting.

Course Outcomes: Upon completing the course students will be able to:

- Explain the fundamental concepts and benefits of Building Information Modeling (BIM).
- Create and manipulate BIM models using industry-standard software.
- Apply BIM for collaboration, coordination, and clash detection in construction projects.
- Utilize BIM for construction management tasks such as scheduling and quantity takeoff.

Contents

Module 1:

Introduction to BIM: Introduction to BIM concepts and history, Benefits of BIM in construction projects, BIM software and tools overview.

Module 2:

BIM Fundamentals: Building elements and components, BIM data exchange standards, BIM project life cycle stages

Module 3:

BIM Modeling and Software: Introduction to BIM modeling techniques, Hands-on training with BIM software, Creating basic building elements in BIM

Module 4:

BIM for Construction Management: BIM in construction scheduling, Quantity takeoff and cost estimation using BIM, BIM for construction documentation.

Module 5:

Advanced BIM Topics: BIM for facility management, BIM in sustainability and energy analysis, Industry case studies and future trends in BIM

Textbooks:

1. "Building Information Modeling: A Strategic Implementation Guide" by Michael Tardif and Sasha Reed (2015)
2. "BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers, and Contractors" by Chuck Eastman, Paul Teicholz, Rafael Sacks, and Kathleen Liston (2014)
3. "BIM in Small-Scale Sustainable Design" by François Lévy (2011)

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

Syllabus of Value Added Course

Course Name: Computer Aided Steel Structures

Course Objectives:

- Gain a comprehensive understanding of steel as a construction material, its properties, and its applications in structural engineering.
- Learn to analyze steel structures for various types of loads and boundary conditions, using both manual calculations and computer-aided tools.
- Develop proficiency in using computer-aided design (CAD) software for creating detailed drawings and 3D models of steel structures.
- Acquire skills in using structural analysis software to model and analyze steel structures, interpreting the results effectively

Course Outcomes: Upon completing the course students will be able to:

- Perform structural analysis of steel structures using both manual methods and structural analysis software, ensuring structural stability and safety.
- Create detailed 2D and 3D models of steel structures using CAD software, facilitating effective communication and visualization of designs.
- Design steel structures in compliance with relevant design codes and standards, accounting for factors such as load combinations and safety margins.
- Analyze and design steel connections, ensuring their integrity and efficiency in transferring loads.

Contents

Module 1:

Introduction to Steel Structures: Overview of steel as a construction material, Types of steel structures, Structural elements and connections, Safety considerations in steel construction, Static equilibrium and loads on structures, Analysis of simple steel structures using hand calculations, Introduction to structural analysis software

Module 2:

Introduction to Computer-Aided Design (CAD) Software: Overview of CAD software for steel structures, Drawing basic steel structural elements, Creating 2D and 3D models of steel structures

Module 3:

Structural Analysis Software: Introduction to structural analysis software, Input data and analysis settings, Analyzing and interpreting results for steel structures.

Module 4:

Structural Design Codes and Standards: Overview of relevant design codes, Load combinations and safety factors, Design criteria for steel structures.

Textbooks:

- "Structural Steel Design" by Jack C. McCormac and Stephen F. Csernak (2016)
- "Steel Design" by William T. Segui (2017)
- "Computer Analysis & Reinforced Concrete Design of Beams" by Fady R. S. Rostom (2017)

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

Syllabus of Value Added Course

Course Name: Importance of software in civil engineering construction

Course Objectives:

- Understand the role and importance of software in civil engineering construction projects.
- Identify and evaluate various software tools used in different phases of construction projects.
- Apply software for project planning, design, analysis, and management tasks.
- Analyze case studies to assess the impact of software on project efficiency, cost, and quality.

Course Outcomes: Upon completing the course students will be able to:

- Describe the historical development and evolution of software applications in civil engineering construction.
- Evaluate and select appropriate software tools for specific construction project requirements.
- Utilize software for project scheduling, resource allocation, and cost estimation.
- Conduct structural analysis and design using software for various construction materials and methods.

Contents

Module 1:

Introduction to Software in Civil Engineering Construction: Historical development of software in construction, Current trends and challenges, Importance of software in civil engineering projects, Overview of software categories in construction.

Module 2:

Project Planning and Management Software: Introduction to project management software (e.g., Microsoft Project), Project scheduling and resource allocation, Cost estimation and budgeting, Risk assessment and mitigation using software tools.

Module 3:

Structural Analysis and Design Software: Structural analysis software (e.g., SAP2000, ETABS), Design software for various construction materials, Performance-based design using software, Case studies on structural design projects.

Module 4:

Building Information Modeling (BIM) Applications: Introduction to Building Information Modeling (BIM), BIM software (e.g., Revit, ArchiCAD), 3D modeling and visualization in construction, Clash detection and coordination in BIM.

Module 5:

Geographic Information Systems (GIS) in Construction: GIS principles and applications in construction, Site selection and planning using GIS software, Data integration for construction projects, Environmental impact assessment with GIS.

Textbooks:

1. "Project Management with CPM, PERT, and Precedence Diagramming" by Joseph J. Moder, Cecil R. Phillips, and Edward W. Davis
2. "Construction Planning, Equipment, and Methods" by R. L. Peurifoy, Clifford J. Schexnayder, and Aviad Shapira
3. "Principles of Structural Design: Wood, Steel, and Concrete" by Ram S. Gupta
4. "GIS Tutorial 1: Basic Workbook" by Wilpen L. Gorr and Kristen S. Kurland

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

Syllabus of Value Added Course

Course Name: REVIT Architecture

Course Objectives:

- Understand the principles of Building Information Modeling (BIM) and become proficient in navigating and utilizing the Revit Architecture interface.
- Learn to create and manipulate architectural components such as walls, doors, and windows, while also exploring techniques for editing and modifying these elements.
- Gain skills in generating 3D views, creating section views, and using rendering techniques to produce visualizations and walkthroughs of architectural designs.
- Develop the ability to organize views, create schedules, and arrange documentation elements for effective project presentation and submission.

Course Outcomes: Upon completing the course students will be able to:

- Effectively navigate the Revit Architecture interface, demonstrating a solid understanding of key tools and functionalities for building information modeling.
- Capable of creating, placing, and editing essential architectural components, such as walls, doors, and windows, showcasing proficiency in accurately representing building structures.
- Generate diverse visualizations, including 3D views, section views, and rendering techniques, enabling them to communicate design concepts more effectively.
- Organize views, develop schedules, and arrange documentation elements systematically, resulting in coherent and professional project presentations suitable for submission and review.

Contents:

1. Introduction to Building Information Modeling
2. Revit Architecture Introduction
3. User Inter Face
4. Setting of Units & Working with Elevation Views
5. Placing Walls, Doors & windows
6. Editing of Walls, Doors & Windows
7. Properties Palette
    - Type Selector
    - Type Parameters
    - Instance Parameters
8. Managing Views by Project Browser
9. Placing of Family Files(Components)
10. Modify Tools
11. Roof & Types of Roofs
12. Floor & Types of Floors
13. Ceiling
14. Explain about Curtain wall
15. Creating Section Views
16. Different Types of Openings
17. Staircase

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA - 516 003. (A.P.)

18. Ramp
19. Railing
20. Annotations
21. Model Text
22. 3-D Views
    - Camera Views
    - Rendering
    - Walkthroughs
23. Paint
24. Creating New Materials
25. Massing & Site
26. Schedules
27. Page Layout
28. Documentation
29. Project Submission

Textbooks:

1. Atefe Makhmalbaf (2022), Building Information Modeling using Revit for Architects and Engineers, Mavs Open Press.
2. Revit Essentials for Architecture by Paul F. Aubin, https://paulaubin.com/books/ revitessentials -for-architecture/.

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(Autonomous)
KADAPA - 516 003. (A.P.)