INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

CIVIL ENGINEERING

COURSE DESCRIPTION

Course Title	:	**CONCRETE TECHNOLOGY**			
Course Code	:	A50116			
Regulation	:	R15(JNTUH)			
Class	:	III - B. Tech, I Semester			
Course Structure	:	Lectures	Tutorials	Practical's	Credits
		4	-	-	4
Course Coordinator	:	Mr,SurajBaraik Assistant Professor, Civil Engineering Mr N Venkat Rao, Assistant Professor, Civil Engineering			
Team of Instructors	:	Mr. Suraj Baraik, Assistant Professor, Civil Engineering Mr N Venkat Rao, Assistant Professor, Civil Engineering			

I. COURSE OVERVIEW

Concrete technology provides a comprehensive coverage of the theoretical and practical aspects of the subject and includes the latest developments in the field of concrete construction. It incorporates the latest Indian standard specifications and codes regulating concrete construction. The properties of concrete and it constituent materials and the role of various admixtures in modifying these properties to suit specific requirements, such as ready mix concrete, reinforcement detailing, disaster-resistant construction, and concrete machinery have been treated exhaustively the and also special concrete in addition to the durability maintenance and quality control of concrete structure.

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	4	Building Materials & Construction Planning

III. MARKS DISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks
There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment. The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. There shall be two assignments in every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with course. critical thinking. Marks shall be awarded considering the average of two midterm tests in each.	75	100

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

V. COURSE OBJECTIVES

The objective of the teacher is to impart knowledge and abilities to the students to:

I. Understand the theoretical concept of Concrete material which includes Cement, Admixtures and Aggregates,
II. Learn different types of aggregates, admixtures & know the mechanism of hydration of cement.
III. Comprehend the properties of Fresh Concrete, & manufacturing process of concrete.
IV. Understand the properties of hardened concrete, factors affecting Elasticity, creep & Shrinkage in concrete.
V. Understand the concept of mix design ofconcrete& its importance in estimation of composition of materials.
VI. Know various types of special concretes & its application.

VI. COURSE OUTCOMES

After completing this course the student must demonstrate the knowledge and ability to:

1. Explain the properties of the constituent materials of concrete.
2. Describe the physical & mechanical properties of aggregates.
3. Study the behavior of concrete at its fresh and hardened state, describe and carry out tests relevant to the use of concrete on site.
4. Explain factors affecting strength of concrete.
5. Understand the factors influencing concrete mix & know the BIS method of mix design.
6. Define special concretes, their application for practical purpose.

HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments, Exams
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	H	Assignment, Exams
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	S	Assignment, Exams
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of	S	Assignment, Exams

	experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.		
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	-	-
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	S	-
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	-	-
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	S	Discussion
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	-	-
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	S	Discussions
PO11	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	-	-
PO12	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	-	-

S – Supportive **H - Highly Related**

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**ENGINEERING KNOWLEDGE:**Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.	H	Lectures, Assignments, Exams
PSO2	**BROADNESSAND DIVERSITY:** Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.	H	Lectures, Assignments, Exams
PSO3	**SELF-LEARNING AND SERVICE:**Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.	S	Guest Lecture, Possible Group Projects, Industrial Internship

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VIII. SYLLABUS

UNIT I

CEMENTS & ADMIXTURES: Portland cement – chemical composition – Hydration, Setting of cement – Structure of hydrate cement – Test on physical properties – Different grades of cement

ADMIXTURES – Mineral and chemical admixtures – properties – dosage – effects- usage.

AGGREGATES: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum aggregate size.

UNIT – II

FRESH CONCRETE: Workability – Factors affecting workability – Measurement of workability by different tests – Setting times of concrete – Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete – Steps in manufacture of concrete – Quality of mixing water.

UNIT – III

HARDENED CONCRETE : Water / Cement ratio – Abram's Law – Gel space ratio – Nature of strength of concrete – Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength - Curing.

TESTING OF HARDENED CONCRETE: Compression tests – Tension tests – Factors affecting strength – Flexure tests – Splitting tests – Non-destructive testing methods – codal provisions for NDT.
ELASTICITY, CREEP & SHRINKAGE – Modulus of elasticity – Dynamic modulus of elasticity – Posisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – types of shrinkage.

UNIT – IV

MIX DESIGN : Factors in the choice of mix proportions – Durability of concrete – Quality Control of concrete – Statistical methods – Acceptance criteria – Proportioning of concrete mixes by various methods – BIS method of mix design.

UNIT – V

SPECIAL CONCRETES: Light weight aggregates – Light weight aggregate concrete – Cellular concrete – No-fines concrete – High density concrete – Fibre reinforced concrete – Different types of fibres – Factors affecting properties of F.R.C – Applications – Polymer concrete – Types of Polymer concrete – Properties of polymer concrete – Applications – High performance concrete – Self consolidating concrete – SIFCON.

Textbooks:

1. Properties of Concrete by A.M.Neville – Low priced Edition – 4th edition
2. Concrete Technology by M.S.Shetty. – S.Chand& Co. ; 2004

Reference Books:

1. Concrete Technology by M.L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi
2. Concrete Technology by A.R. Santha Kumar, Oxford university Press, New Delhi

IX. COURSE PLAN:

Unit	Lecture Number	Topics Planned to cover	Learning Objectives
Course Content Delivery --- Lecture Wise Break-up of Topics I SPELL			
I	1,2	History of port land cement	To understand how the cement was invented
	3,4	Manufacturing of Portland cement	To learn the manufacturing process of Portland cement
	5,6	Chemical composition &Bogues compounds of Portland cement.	To understand the chemical compounds present in cement
	7	Hydration, Setting of cement, Structure of hydrate cement	To understand the hydration of the cement
	8	Test on physical properties	To learn the physical properties
	9	Different grades of cement	Able to know the various grades of cement
	10,11	Classification of aggregate, Particle shape and texture, Bond, strength and other mechanical properties of aggregate	To learn the effect of aggregates on concrete
	12	Specific gravity, Bulk density, porosity, adsorption and moisture content of aggregate, Bulking of sand, Deleterious substance in aggregate	To understand the effect of physical properties of cement on strength
	13	Soundness of aggregate, Alkali aggregate reaction, Thermal properties	To learn the soundness of concrete
	14	Sieve analysis, Fineness modulus, Grading curves, Grading of fine and coarse Aggregates, Gap graded aggregate, Maximum aggregate size	To separate the sizes of aggregates
II	15,16	Introduction, Workability, Factors affecting workability	To understand Rheology
	17,18	Measurement of workability by different tests, Setting times of concrete	Able to know the workability of concrete
	19,20	Effect of time and temperature on workability, Segregation and bleeding	To know the effect of time and temperature on strength
	21,22	Mixing and vibration of concrete, Steps in manufacture of concrete, Quality of mixing water	To know the steps in making concrete
	23,24	Water / Cement ratio, Abram's Law, Gel space ratio and problems	To know the water /cement ratio
	25,26	Nature of strength of concrete, Maturity concept, Strength in tension and compression	To understand the maturity concept

	27,29	Factors affecting strength, Relation between compression and tensile strength, Curing	To understand the effect of curing on strength of the concrete
III	30	Introduction on HARDENED CONCRETE	To understand what is hardened concrete
II Spell			
III	31	Compression tests, Tension tests	Able to know various strength tests on concrete
	32,33	Factors affecting strength, Flexure tests	To learn the factors affect the strength of concrete
	34,35	Splitting tests, Non-destructive testing methods, codal provisions for NDT	To understand NDT
	36	Modulus of elasticity, Dynamic modulus of elasticity, Poisson's ratio	To understand the concept of poisson's ration and elasicity
	37,38	Creep of concrete, Factors influencing creep, Relation between creep and time	To understand the creep in concrete
	39	Nature of creep, Effects of creep	To understand the creep in concrete
	40	Shrinkage, types of shrinkage.	To know the effect of shrinkage on concrete
	41	Problems on modulus of elasticity, shrinkage, creep of concrete	To know the problems of shrinkage and creep on concrete
IV	42	Introduction on different mixes of concrete	To understand different mixes of concrete
	43,44	Factors in the choice of mix proportions, Durability of concrete	To understand durability of concrete
	45,46	Quality Control of concrete, Statistical methods	To learn quality control of concrete
	47	Acceptance criteria, proportioning of concrete mixes by various methods	To learn concrete mixes by various methods
	48,49	BIS method of mix design	To learn the BIS mix design method
	50,51	Problems on different mix designs of concrete.	Able to know the problems of different mix design of concrete
V	52,53	Introduction to special concrete	To understand what is special concrete
	54,55, 56	Light weight aggregates, Light weight aggregate concrete	To know the concept of light weight concrete
	57, 58, 59	Cellular concrete, No-fines concrete, High density concrete	Able to know the concept of cellular concrete
	60, 61, 62	Fibre reinforced concrete, Different types of fibres,	To understand various types FRC
	63, 64, 65	Applications, Polymer concrete, Types of Polymer concrete,	To learn the applications of polymers in concrete

	66, 67, 68,	Applications, High performance concrete, Self consolidating concrete, SIFCON	To understand SCC
	69, 70, 71	Factors affecting properties of F.R.C	To understand various types FRC
	71, 72 73	Properties of polymer concrete	To learn the applications of polymers in concrete

X. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	H			S						S			S		S
II	H			S						H			H	H	
III	S			S						S			S		
IV	S			S						H			H	H	
V	H	S	S							S			S	H	
VI	H			S						H			S		H

S=Supportive **H=Highly Related**

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	H			H						H			S		S
2	H			H						S			H		
3	S			S						H			S	H	S
4	H			H						H			H	H	
5	H	H	H							S			S		
6	S			S						S			H		S

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Prepared By: Mr. Suraj Baraik, Assistant Professor**,** Civil Engineering Department

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