Course Objectives

CMR Institute of Technology, Bangalore		
Department(s): EEE,CSE,CIV		
Semester: 04	Section: A	Lectures/week: 05
Subject: Engineering Mathematics IV		Code: 15MAT41
Course Instructor: R.REVATHI		
Course duration: 05 Feb 2018 – 23 May 2018		
Course Site: https://sites.google.com/a/cmrit.ac.in/revathi-raman7744/		

- The purpose of this course is to make students well conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory and joint probability distribution and stochastic processes.

Prerequisites

- Basic Differential and Integral Calculus
- Power series expansions of functions
- Limits, Continuity and differentiability of functions of real variables
- Complex numbers-Representation in Cartesian and polar forms, algebra of complex numbers
- De Moivre theorem
- Basics of Probability
- Mean, Standard deviation of ungrouped data.

Lesson Plan

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1-8	TB1: 32.1,32.3, 32.5,32.7, 32.9, 32.10 TB1: 32.12	**Numerical Methods (Module-1 & 2)** Numerical Solution of 1st Order ODE- Taylor Series method, Modified Euler method, Runge-Kutta method, Milne's and Adams Bashforth methods Solution of second order differential equations- Runge-Kutta method, Milne's method	Chalk and Talk	20

Links to some useful online lectures:

- Introduction to complex functions: https://www.youtube.com/watch?v=iUhwCfz18os
- Conformal maps: https://www.youtube.com/watch?v=CMMrEDIFPZY

09-25	TB2: 13.1,13.2 TB1: 20.1-20.5, 20.7-20.10, 20.12-20.14, 20.18	**Complex Variables (Module-3)** Function of a complex variable, limits, continuity, differentiability Cauchy-Riemann equations in polar form, problems, Evaluation of line integrals, Cauchy's theorem, Evaluation of integrals, Evaluation of residues at poles, Evaluation of integrals using residue theorem Problems on BLT, The mapping $w = e^z$, $w = z + 1/z$, $(z \neq 0)$	Chalk and Talk	27
Links to some useful online lectures: ➢ Euler Method for Differential Equations - the basic idea: https://www.youtube.com/watch?v=RGtCw5E7gBc				
26-40	TB1 26.7 - 26.16, 2.19(6) TB2:24.2, 24.3 RB2:31.1	**Probability Distributions (Module-4)** Probability- prerequisites, Random variables and probability distributions, Discrete probability distributions- mean and variance, problems. Continuous probability distributions- mean and variance, problems. Binomial Distribution, mean and variance of binomial distribution, Problems on binomial distribution, Poisson distribution, mean variance of Poisson distribution, Exponential distribution, Normal distribution, mean and variance of normal distribution Problems on normal distribution. **Joint probability distributions:** expectation, covariance, correlation coefficient Problems on joint probability distributions.	Chalk and Talk	20
Links to some useful online lectures: ➢ Prerequisites: https://www.youtube.com/watch?v=uzkc-qNVoOk&list=PLC58778F28211FA19 ➢ Random variables: https://www.youtube.com/watch?v=IYdiKeQ9xEI				
41-51	RB2: 31.2 TB1: 27.1 - 27.18	**Stochastic processes and Sampling theory (Module-5)** Stochastic processes- Introduction, regular stochastic matrix, Markov chain, transition matrix, problems on Markov Chain. Sampling theory- Introduction, sampling distribution of means and proportions , problems. Test of hypothesis and confidence intervals for means and proportions, problems. Test of hypothesis for difference of means and proportions, problems. Small samples- Student's t-distribution. Test of goodness of fit : Chi-square distribution.	Chalk and Talk, Video lectures (flipped class)	20
Links to some useful online lectures: ➢ Sampling distribution : https://www.youtube.com/watch?v=olK80ngCbXc ➢ Confidence Intervals: https://www.youtube.com/watch?v=9jTJD5SLweY ➢ Testing hypotheses: https://www.youtube.com/watch?v=vwWEa8wU_6U				

➢ Introduction to Markov chains: https://www.youtube.com/watch?v=AaP8Zr0yoF4&t=151s				
52-60	TB1:16.1, 16.2,16.4-16.8,16.11,16.13,16.14	**Special Functions (Module-2)** Series solution of Legendre's differential equation leading to $P_n(x)$, Rodrigue's formula, Legendre polynomials, problems. Series solution of Bessel's differential equation leading to $J_n(x)$ by Frobenius method, properties of Bessel functions, recurrence relations, problems, Orthogonality of Bessel functions.	Chalk and Talk	13
Links to some useful online lectures: ➢ Series solution of o.d.e: https://www.youtube.com/watch?v=c3XtwTsE7QY ➢ Legendre's o.d.e: https://www.youtube.com/watch?v=3e5BUrtUKZc&t=11s ➢ Introduction to the Frobenius method: https://www.youtube.com/watch?v=_qQLuxYClA4				

Text Books	
1.	B.S.Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd edition, 2015
2.	E.Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2015.
Reference Books	
1.	N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers,
2.	*B.V.Ramana: "Higher Engineering M athematics" Tata McGraw-Hill, 2006.*
3.	*H. K. Dass and Er. RajnishVerma: "Higher Engineerig Mathematics", S. Chand publishing, 1st edition, 2011.*

Syllabus for Internal Assessment Tests (IAT*)

IAT #	Syllabus
IAT-1	Class # 01 – 20
IAT-2	Class # 21– 41
IAT-3	Class # 42– 60

*See calendar of events for IAT schedule.

Course Outcomes	
By the end of this course, students will be able to	
1.	Use appropriate single-step and multi-step numerical methods to solve first and second order ordinary differential equations.
2.	Use Power Series method and Frobenius method to find the solution of second order differential equations such as Legendre and Bessel differential equations.
3.	Apply the idea of analyticity and the calculus of residues to evaluate real and complex integrals and to describe conformal transformations.
4.	Describe random variables and probability distributions using rigorous statistical methods and translate real-world problems into probability models.
5.	Explain and successfully apply parametric testing techniques including single and multi-sample tests for mean and proportion.
6.	Estimate the nature and strength of relationship between two variables of interest using joint probability distribution and describe a discrete time Markov chain in terms of a transition matrix.

**Based on table 01, 02, 03 in appendix, following are the Course outcomes.

Course Outcomes		Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Use appropriate single-step and multi-step numerical methods to solve first and second order ordinary differential equations.	**1,2**	3	3	1	1	-	1	-	-	1	-	-	1	1	-	1	-
CO2	Use Power Series method and Frobenius method to find the solution of second order differential equations such as Legendre and Bessel differential equations.	**2**	1	3	-	-	-	-	-	-	1	-	-	2	1	-	1	-
CO3	Apply the idea of analyticity and the calculus of residues to evaluate real and complex integrals and to describe conformal transformations.	**3**	2		-	-	-	-	-	-	1	-	-	-	-	-	1	-
CO4	Describe random variables and probability distributions using rigorous statistical methods and translate real-world problems into probability models.	**4**	3	2	-	2	-	-	-	-	1	-	-	-	-	-	1	-
CO5	Explain and successfully apply parametric testing techniques including single and multi-sample tests for mean and proportion.	**5**	2	2	-	1	2	-	-	-	1	-	-	2	1	-	1	-
CO6	Estimate the nature and strength of relationship between two variables of interest using joint probability distribution and describe a discrete time Markov chain in terms of a transition matrix.	**5**	3	2	-	1	-	-	-	-	1	-	-	-	1	1	1	-

Note: Assignments, study material, Question bank and other course related content would be posted on site mentioned above.

Signature with date: | **Course Instructor** **Program Coordinator** **Head-CSE**

Appendix

Table 01: Cognitive Levels

Cognitive Levels	
Cognitive level	**Revised Blooms Taxonomy Keywords**
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.

L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

Table 02: Program Outcomes (PO) and Program Specific Outcomes (PSO)

Program Outcomes (PO), Program Specific Outcomes (PSO)	
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of 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 modelling 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.
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.
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.
PO11	**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.
PO12	**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.
PSO1	Apply electrical and electronic principles to circuits, machines, power systems and control systems
PSO2	Develop solutions in the areas of industrial automation, green energy systems and smart grids
PSO3	Able to contribute to project teams in the core and associated domains of electrical and electronic technology

Table 03: Correlation Levels

Correlation Levels	
0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

CMR Institute of Technology, Bangalore			
Department(s): Civil Engineering			
Semester: 04	Section(s): A&B		
Analysis of Determinate structures		15CV42	Lectures/week: 05
Course Instructor(s): Navanath M Prabha			
Course duration: 05 FEB., 2018 – 25 May 2018			

Course Objectives: After the completion of the course student will be able to

- Apply knowledge of mathematics and engineering in calculating slope and deflections
- Identify, formulate and solve engineering problems
- Analyse structural systems and interpret data
- Engage in lifelong learning with the advances in Structural Engineering

Prerequisites

- Types of supports and support reactions
- Shear force and bending moment

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1-12	TB1: - 1.1-1.5 & 2.4- 2.5	**MODULE-I: Introduction and Analysis of Plane Trusses** Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and non linear analysis, Static and kinematic indeterminacies of structural systems, Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections	Chalk and Talk	20
Links to some useful online lectures: ➢				
12-24	TB1 3.1 - 3.3 4.1- 4.2	**MODULE-II:Deflection of Beams** Definition of slope, Deflection and curvature, Sign conventions, Derivation of moment-curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple. Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts. Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections.	Chalk and Talk Video Lectures for some topics	40

Links to some useful online lectures: ➢				
24-38	TB1 5.1 - 5.4	**MODULE-III:Energy Principles and Energy Theorems** Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the point of application of single load, Castigliano's theorems and its application to estimate the deflections of trusses, bent frames, Special applications-Dummy unit load method.	Chalk and Talk	60
Links to some useful online lectures: ➢				
38-44	TB1 7.1- 7.7 8.0 -8.5	**MODULE-IV:Arches and Cable Structures** Three hinged parabolic arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.	Chalk and Talk Video Lectures for some topics	80
Links to some useful online lectures: ➢				
44-56	TB1 6.1 – 6.12	**MODULE-V:Influence Lines and Moving Loads** Concepts of influence lines-ILD for reactions, SF and BM for determinate beams-ILD for axial forces in determinate trusses- Reactions, BM and SF in determinate beams using rolling loads concepts.	Chalk and Talk	100
Links to some useful online lectures: ➢				

Text Books	
1.	Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., New Delhi,2015.
2.	Bhavikatti, Structual Analysis, Vikas Publishing House Pvt. Ltd, New Delhi, 2002.
Reference Books	
2.	Hibbeler R C, Structural Analysis, Prentice Hall, 9th edition, 2014

Syllabus for Internal Assessment Tests (IAT)*

IAT #	Syllabus
IAT-1	Class # 01 – 18
IAT-2	Class # 19– 37
IAT-3	Class # 38– 56

* : See calendar of events for the schedules of IATs.

Course Outcomes
By the end of this course, students will be able to

1. Analyze the trusses by method of joints and section
3. Calculate slope and deflections for beams and trusses
4. Analyse cables and three hinged arches
5. Explain the concept of influence line diagram and rolling loads

COGNITIVE LEVELS	
Cognitive level	**REVISED BLOOMS TAXONOMY KEYWORDS**
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)	
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of 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.
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.

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.
PO11	**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.
PO12	**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.
PSO1	Apply knowledge and skills to perform diverse tasks of construction industry
PSO2	Analyze, design and develop construction information details of simple structural elements and basic civil engineering systems
PSO3	Support diverse tasks of construction project management as construction engineer
PSO4	Pursue interests in specializations leading to bigger and diverse career opportunities

CORRELATION LEVELS	
0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

Course Outcomes		**Modules covered**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	Analyze the trusses by method of joints and section	**1**	3	2	-	1	-	1	-	-	-	-	-	1	1	2	-	2
CO2	Calculate slope and deflections for beams and trusses	**2,3**	3	2	-	1	-	1	2	1	2	-	-	1	1	2	-	2
CO3	Analyse cables and three hinged arches	**4**	3	2	-	1	-	2	1	-	1	-	-	1	1	2	-	2
CO4	Explain the concept of influence line diagram and rolling loads	**5**	3	2	-	-	-	1	-	-	-	-	-	1	1	2	-	2

CMR Institute of Technology, Bangalore		
Department(s): Civil Engineering		
Semester: 04	Section(s): A&B	
Course Name: Applied Hydraulics	15CV43	Lectures/week: 04
Course Instructor(s): Karnapa Ajit		
Course duration: 05 Feb. 2018 – 25 May 2018		

Course Objectives

The objectives of this course is to make students to learn

- Principles of dimensional analysis to design hydraulic models and design of various models.
- Design the open channels of various cross sections including design of economical sections.
- Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.
- The working principles of the hydraulic machines for the given data and analyzing the performance of turbines for various design data.

Prerequisites

- Engineering Mathematics
- Fluid Mechanics

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1-10	TB2: - 12.1-12.11, 4.1-4.8	**Module 1: Dimensional and Model analysis** **Dimensional analysis** Dimensional analysis and similitude: Dimensional Homogeneity, Non Dimensional parameter, Rayleigh methods and Buckingham p theorem, dimensional analysis, choice of variables, examples on various applications. **Model analysis:** Model analysis, similitude, types of similarities, force ratios, similarity laws, model classification, Reynolds model, Froude's model, Euler's Model, Webber's model, Mach model, scale effects, Distorted models. Numerical problems on Reynold's, and Froude's Model. **Buoyancy and Flotation** Buoyancy, Force and Centre of Buoyancy, Metacentre and Metacentric height, Stability of submerged and floating bodies, Determination of Metacentric height, Experimental and theoretical method, Numerical problems	Chalk and Talk Video Lectures for some topics	20

Links to some useful online lectures:

- http://nptel.ac.in/courses/105103095/56
- http://nptel.ac.in/courses/105103095/17
- https://www.youtube.com/watch?v=QUgXf2Rj2YQ

11-20	TB2 16.1-16.7	**Module 2: Open Channel Flow Hydraulics** **Uniform Flow** Introduction, Classification of flow through channels, Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical Problems. Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Metering flumes, Numerical Problems	Chalk and Talk Video Lectures for some topics	20
Links to some useful online lectures: ➢ http://nptel.ac.in/courses/105107059/ ➢ https://www.youtube.com/watch?v=-jb5A9GIuNQ				
21-30	TB2 16.8-16.9	**Module 3: Non-Uniform Flow** Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical, horizontal and adverse slope profiles, Numerical problems, Control sections	Chalk and Talk	20
Links to some useful online lectures: ➢ http://nptel.ac.in/courses/105107059/ ➢ www.youtube.com/watch?v=VbsZRqpcJ4w				
31-40	TB2 18.1-18.6	**Module 4: Hydraulic Machines** Introduction, Impulse-Momentum equation. Direct impact of a jet on a stationary and moving curved vanes, Introduction to concept of velocity triangles, impact of jet on a series of curved vanes- Problems **Turbines – Impulse Turbines** Introduction to turbines, General lay out of a hydro-electric plant, Heads and Efficiencies, classification of turbines. Pelton wheel-components, working principle and velocity triangles. Maximum power, efficiency, working proportions – Numerical problems	Chalk and Talk Video Lectures for some topics	20
Links to some useful online lectures: ➢ http://nptel.ac.in/courses/112104117/27 ➢ www.youtube.com/watch?v=9jAZ2eWy-Q4 ➢ www.youtube.com/watch?v=k0BLOKEZ3KU				
41-50	TB2 18.8-18.14	**Module 5: Reaction Turbines and Pumps** Radial flow reaction turbines: (i) Francis turbine- Descriptions, working proportions and design, Numerical problems. (ii) Kaplan turbine- Descriptions, working proportions and design, Numerical problems. Draft tube theory and unit quantities. (No problems) Centrifugal pumps: Components and Working of centrifugal pumps, Types of centrifugal pumps, Work done by the impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pump, Numerical problems, Multi-stage pumps.	Chalk and Talk	20

Links to some useful online lectures:

- http://nptel.ac.in/courses/105103021/41

Text Books	
1.	P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi
2.	R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
3.	S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill,New Delhi
Reference Books	
6.	K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd.
7.	Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press
8.	C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, *"Fluid Mechanics and Machinery"*, Oxford University Publication – 2010
9.	.B. Evett, and C. Liu, *"Fluid Mechanics and Hydraulics*", McGraw-Hill Book Company.- 2009.

Syllabus for Internal Assessment Tests (IAT) *

IAT #	Syllabus
IAT-1	Class # 01 – 20
IAT-2	Class # 20– 35
IAT-3	Class # 35– 50

* : See calendar of events for the schedules of IATs.

Course Outcomes	
By the end of this course, students will be able to	
1.	Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters
2.	Design the open channels of various cross sections including economical channel sections
3.	Apply Energy concepts to flow in open channel sections, Calculate Energy dissipation, Compute water surface profiles at different conditions
4.	Design turbines for the given data, and to know their operation characteristics under different operating conditions

COGNITIVE LEVELS	
Cognitive level	**REVISED BLOOMS TAXONOMY KEYWORDS**
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
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	change, classify, experiment, discover.
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PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)	
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of 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.
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PO11	**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.
PO12	**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.

PSO1	Apply knowledge and skills to perform diverse tasks of construction industry.
PSO2	Analyse, design and develop construction information details of simple structural elements and ba sic civil engineering systems
PSO3	Support diverse tasks of construction project management as construction engineer
PSO4	Pursue interests in specializations leading to bigger and diverse career opportunities

CORRELATION LEVELS	
0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

Course Outcomes		**Modules covered**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters	**1**	3	2	2	1	0	0	0	0	0	0	0	0	3	3	1	1
CO2	Design the open channels of various cross sections including economical channel sections	**2**	3	1	2	0	0	0	0	0	0	0	0	0	3	3	1	1
CO3	Apply Energy concepts to flow in open channel sections, Calculate Energy dissipation, Compute water surface profiles at different conditions	**3**	3	1	1	0	0	0	0	0	0	0	0	0	3	3	1	1
CO4	Design turbines for the given data, and to know their operation characteristics under different operating conditions	**4,5**	2	2	1	1	0	0	0	0	0	0	0	0	3	3	1	1

CMR Institute of Technology, Bangalore			
Department(s): Civil Engineering			
Semester: 04	Section(s): A&B		
Concrete Technology		15CV44	Lectures/week: 04
Course Instructor(s): Shivakumara M J			
Course duration: 05 Feb., 2018 – 25 May 2018			

Course Objectives

This course will enable students to:

1. Recognize the importance of material characteristics and their contributions to strength development in Concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

Prerequisites

- Basics principle of Physics and Chemistry

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1-231	TB2: - 1.1 – 5.55	**Module-1: Concrete Ingredients** Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Flyash, GGBS, silica fumes, Metakaolin and rice husk ash.	Chalk and Talk	20
Links to some useful online lectures: ➢ http://nptel.ac.in/courses/103106108/24 ➢ http://nptel.ac.in/courses/105102012/ ➢ http://nptel.ac.in/courses/105102012/9 ➢ http://nptel.ac.in/Clarify_doubts.php?subjectId=105102012&lectureId=11				
233-314	TB2 6.1 – 6.9	**Module -2: Fresh Concrete** Workability-factors affecting workability. Measurement of workability–slump, Compaction	Chalk and Talk	20

		factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self-curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.	Video Lectures for some topics	
Links to some useful online lectures: ➢ http://textofvideo.nptel.ac.in/105102012/lec21.pdf				
316-490	TB 7.1 – 8.3 9.1-9.41 10.1-10.15	**Module -3: Hardened Concrete** Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –factors affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per IS-456, Insitu testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.	Chalk and Talk Video Lectures for some topics	20
Links to some useful online lectures: ➢ http://www.nptel.ac.in/courses/105106117/pdf/1_Introduction/1.5_Concrete_I.pdf ➢ http://www.theconcreteportal.com/hard_strength.html				
492-536	TB2 11.1- 11.18	**Module -4: Concrete Mix Proportioning** Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262	Chalk and Talk	20
Links to some useful online lectures: ➢ http://courses.washington.edu/cm425/mix.pdf ➢ http://www.ce.memphis.edu/1112/notes/project_2/PCA_manual/Chap09.pdf				
537-641	TB2 12.1 - 13.11	**Module -5: Special Concretes** RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix. Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and applications	Chalk and Talk Video Lectures for some topics	20

Links to some useful online lectures:

- http://nptel.ac.in/syllabus/105102012/
- http://nptel.ac.in/Clarify_doubts.php?subjectId=105102012&lectureId=38

Text Books	
1.	Neville A.M. "Properties of Concrete"-4th Ed., Longman.
2	M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
Reference Books	
10.	M L Gambir, "Concrete Technology", McGraw Hill Education, 2014.
11.	A.R. Santha Kumar, "Concrete Technology", Oxford University Press, New Delhi (New Edition)

Syllabus for Internal Assessment Tests (IAT)*

IAT #	Syllabus
IAT-1	Class # 01 – 18
IAT-2	Class # 19– 37
IAT-3	Class # 38– 52

* : See calendar of events for the schedules of IATs.

Course Outcomes
By the end of this course, students will be able to
2. Describe manufacture of cement by dry and wet process and summarize the chemical compositions of cement and its influence on physical and chemical properties.
3. Explain physical and mechanical properties of fine and coarse aggregates used for concrete.
12. Experiments to determine workability of concrete and explain its importance.
13. Describe role of admixtures in modifying fresh and hardened state properties of concrete.
14. Use knowledge of factors affecting strength and durability of concrete to give correct mix proportion for specific structural member.
15. Design concrete mix proportion for conventional and special type concretes using the given material properties for a specific construction.

COGNITIVE LEVELS	
Cognitive level	**REVISED BLOOMS TAXONOMY KEYWORDS**
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain,

	infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)	
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of 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.
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.
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.
PO11	**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.
PO12	**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.
PSO1	Design, implement and maintain business applications in a variety of languages using libraries and frameworks.

PSO2	Develop and simulate wired and wireless network protocols for various network applications using modern tools.
PSO3	Apply the knowledge of software and design of hardware to develop embedded systems for real world applications.
PSO4	Apply knowledge of web programming and design to develop web based applications using database and other technologies

CORRELATION LEVELS	
0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

Course Outcomes		**Modules covered**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	Describe manufacture of cement by dry and wet process and summarize the chemical compositions of cement and its influence on physical and chemical properties.	**1**	3	-	-	-	-	-	-	2	-	-	-	1	1	-	-	1
CO2	Explain physical and mechanical properties of fine and coarse aggregates used for concrete.	**1,2**	3	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-
CO3	Experiments to determine workability of concrete and explain its importance.	**2,3,4**	3	-	-	-	1	-	-	-	-	-	-	2	1	1	-	-
CO4	Describe role of admixtures in modifying fresh and hardened state properties of concrete.	**5,6**	3	-	-	-	-	-	-	-	-	-	-	1	1	1	-	-
CO5	Use knowledge of factors affecting strength and durability of concrete to give correct mix proportion for specific structural member.	**7**	3	-	-	-	-	-	-	-	-	-	1	1	1	-	-	-
CO6	Design concrete mix proportion for conventional and special type concretes using the given material properties for a specific construction.	**8**	3	1	3	1	1	-	-	-	-	-	1	1	1		-	1

Note : From time to time, assignments will be posted on

https://sites.google.com/a/cmrit.ac.in/shivakumara-m-j/

Course Objectives

CMR Institute of Technology, Bangalore		
Department(s): Civil Engineering		
Semester: 04	Section(s): A&B	Lectures/week: 05
Subject: Basic Geo technical engineering		Code: 15CV45
Course Instructor(s): Dr. Asha M Nair		
Course duration: 05 February 2018 – 25 May 2018		
Course Site: https://sites.google.com/a/cmrit.ac.in/dr-asha-m-nair/		

- To identify the soil type in a job site, determination of soil properties based on type and to evaluate the design decisions from the understanding of that soil properties.
- To explore the scientific principles used to describe the major engineering properties of soil.
- To explain role of water in soil behavior, soil stresses, permeability and quantity the seepage using flow net.
- To analyse shear parameters and stress changes in soil due to foundation loads.
- To evaluate the magnitude and time-rate of settlement due to consolidation.

Pre requisites

- Knowledge on fundamental properties like Specific gravity, density etc.
- Basic knowledge of stresses and strains.

Lesson Plan

Lecture #	Book & Sections	Topics	Portions coverage: Teaching Aids	Portions coverage: % of Syllabus Covered
1-10	TB1: - 1.1-1.6, 2.1- 2.11 3.1-3.6	**Module -1: Introduction:** Introduction, origin and formation of soil, Phase Diagram, phase relationships, definitions and their inter relationships. Determination of Index properties- Specific gravity, water content, in-situ density and particle size analysis (sieve and sedimentation analysis). Atterberg's Limits, consistency indices, relative density, activity of clay, Plasticity chart, unified and BIS soil classification.	Chalk and Talk Flip class room for some topics	20%
Links to some useful online lectures: ➢ https://onlinecourses.nptel.ac.in/noc18_ce05/preview ➢ https://www.youtube.com/watch?v=QcBrSKwnDRY ➢ https://www.youtube.com/watch?v=5rDHjZ_RJq0 ➢ https://www.youtube.com/watch?v=C10dklH12W0 ➢ https://www.youtube.com/watch?v=Yi8wdl5cN9Y&t=28s				
11-20	TB1 4.1-4.6 5.1-5.6	**Module -2 : Soil Structure and Clay Mineralogy** Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-	Chalk and Talk Video Lectures for some topics	20%

		exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering **Compaction of Soils:** Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-compactive effort & method, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.		
Links to some useful online lectures: ➢ https://www.youtube.com/watch?v=c4i_y6u-tsE ➢ https://www.youtube.com/watch?v=qq09VuGYE1E&t=13s ➢ https://www.youtube.com/watch?v=6-ymJ_8K7h0				
21-30	TB1 6.1-6.6 7.1-7.4	**Module -3: Flow through Soils:** Darcy's law- assumption and validity, coefficient of permeability, Phenomena **Seepage Analysis:** Laplace equation, assumptions, limitations and its derivation. Flow nets- characteristics and applications. Flow nets for sheet piles and below the dam section. Unconfined flow, phreatic line (Casagrande's method –with and without toe filter), flow through dams, design of dam filters. **Effective Stress Analysis**: Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena	Chalk and Talk and presentations	20
Links to some useful online lectures: ➢ https://www.youtube.com/watch?v=HYAExMCaCN8 ➢ https://www.youtube.com/watch?v=0EzoHXEzdwY ➢ https://www.youtube.com/watch?v=sfZf3VwB1bU ➢ https://www.youtube.com/watch?v=cC7SPH2KEY4 ➢ https://www.youtube.com/watch?v=rM38JiyXDU8				
31-40	TB1 9.1-9.8	**Module -4: Consolidation of Soil:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption and limitations. Derivation of Governing differential Equation Pre-consolidation pressure and its determination by Casagrande's method. Normally consolidated, under consolidated and over consolidated soils. Consolidation characteristics of soil (Cc, av, mv and Cv. Laboratory one dimensional consolidation test, characteristics of e-log(σ') curve, Determination of consolidation characteristics of soils-compression	Chalk and Talk Video Lectures for some topics	20

		index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.		
Links to some useful online lectures: ➢ https://www.youtube.com/watch?v=WBVMlf8hIz4 ➢ https://www.youtube.com/watch?v=mNUuxyBCsT0 ➢ https://www.youtube.com/watch?v=bZTN8z0EIrM				
41-52	TB1 10.1-10.9	**Module -5: Shear Strength of Soil:** Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion, Concept of pore pressure, Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions. Total and effective stress paths.	Chalk and Talk	20
Links to some useful online lectures: ➢ https://www.youtube.com/watch?v=M4TNKwuSnAk ➢ https://www.youtube.com/watch?v=bmpn5oNDvOs ➢ https://www.youtube.com/watch?v=HkjVWkyLfig ➢ https://www.youtube.com/watch?v=hq4UlLm8oIs ➢ https://www.youtube.com/watch?v=7Hh45k1gqjU				

Text Books	
1.	Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics- (2000). New Age International (P) Ltd., New Delhi.
2	Punmia B C., Soil Mechanics and Foundation Engineering- (2012), Laxmi Publications.
3	Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering- (1996). 4th Edition. UBS Publishers and Distributors, New Delhi.
4	Braja, M. Das, Geotechnical Engineering- (2002). Fifth Edition. Thomson Business Information India (P) Ltd., India.
Reference Books	
16.	T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley & Sons, 1969.
17.	Donold P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi
18.	Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. (2009), "Tata Mc Graw Hill.
19.	Narasimha Rao A. V. & Venkatrahmaiah C, Numerical Problems, Examples and objective questions in Geotechnical Engineering-. (2000), Universities Press., Hyderabad.
20.	Muni Budhu ,Soil Mechanics and Foundation Engg.- (2010), 3rd Edition, John Wiely & Sons

Syllabus for Internal Assessment Tests (IAT*)

IAT #	Syllabus
IAT-1	Class # 01 – 18
IAT-2	Class # 19– 37
IAT-3	Class # 38– 52

*See calendar of events for IAT schedule.

Course Outcomes
By the end of this course, students will be able to
1. Describe the role of important elements of discrete event simulation and modeling paradigm.
2. Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
3. Interpret the model and apply the results to resolve critical issues in a real world environment.
4. Apply random number variates to develop simulation models
5. Analyze output data produced by a model and test validity of the model
6. Explain the concepts of verification and validation

**Based on table 01, 02, 03 in appendix, following are the Course outcomes.

Course Outcomes		Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	To identify any soil, comprehend its structure and classify the same on the basis of its index properties	**1,2**	2	2	1	-	-	-	-	-	-	-	-	1	-	2	-	2
CO2	To determine compaction characteristics of soil and apply that knowledge to assess field compaction procedures	**2**	2	1	-	-	-	-	-	-	-	-	-	1	-	2	-	2
CO3	To determine permeability of soil and develop conceptual knowledge on seepage pressure and effective stresses in soils	**3**	2	2	1	-	-	-	-	-	-	-	-	1	-	2	-	2
CO4	To determine compressibility characteristics of any soil and estimate consolidation settlement for different practical problems.	**4**	2	2	1	-	-	-	-	-	-	-	-	1	-	2	-	2
CO5	To estimate shear parameters of soils by using the data from different shear tests and comprehend Mohr-Coulomb failure theory	**5**	2	2	1	-	-	-	-	-	-	-	-	1	-	2	-	2

Note: Assignments, study material, Question bank and other course related content would be posted on site mentioned above.

Signature with date:	**Course Instructor**	**Program Coordinator**	**Head-Civil**

Appendix

Table 01: Cognitive Levels

Cognitive Levels	
Cognitive level	**Revised Blooms Taxonomy Keywords**
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.

L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

Table 02: Program Outcomes (PO) and Program Specific Outcomes (PSO)

Program Outcomes (PO), Program Specific Outcomes (PSO)	
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of 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 modelling 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.
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.
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.
PO11	**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.
PO12	**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.
PSO1	Design, implement and maintain business applications in a variety of languages using libraries and frameworks.
PSO2	Develop and simulate wired and wireless network protocols for various network applications using modern tools.
PSO3	Apply the knowledge of software and design of hardware to develop embedded systems for real world applications.
PSO4	Apply knowledge of web programming and design to develop web based applications using database and other technologies

Table 03: Correlation Levels

Correlation Levels	
0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

CMR Institute of Technology, Bangalore		
Department: Civil Engineering		
Semester: 04	Section(s): A&B	
Advanced Surveying	15CV46	Lectures/week: 04
Course Instructor: Guruprasad H C		
Course duration: 05 Feb, 2018 – 25 May 2018		

Course Objectives

- 1. Apply geometric principles to arrive at solutions to surveying problems.
- 2. Analyze spatial data using appropriate computational and analytical techniques.
- 3. Design proper types of curves for deviating type of alignments.
- 4. Use the concepts of advanced data capturing methods necessary for engineering practice.

Prerequisites

- Basic Surveying.

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1-10	TB1: 1.1-4.6	**Module -1: Curve Surveying** Curves – Necessity – Types, Simple curves, Elements, Designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankines deflection angle method (numerical problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two parallel straights (numerical problems on Equal radius and unequal radius). Transition curves Characteristics, numerical problems on Length of Transition curve, 7.5 Vertical curves –Types – (theory).	Chalk and Talk Video Lectures for some topics	20
Links to some useful online lectures: ➢ nptel.ac.in/courses/105107122/37 nptel.ac.in/courses/105107122/39 https://www.youtube.com/watch?v=3rvPfIT3Wro https://www.youtube.com/watch?v=p6ruuib1qsY				
11-20	TB1 8.1 - 8.11	**Module -2: Geodetic Surveying and Theory of Errors** Geodetic Surveying: Principle and Classification of triangulation system, Selection of base line and stations, Orders of triangulation, Triangulation figures, Reduction to Centre, Selection and marking of stations Theory of Errors: Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for giving weights and distribution of errors to the field observations, determination of the most probable values of quantities	Chalk and Talk Video Lectures for some topics	20

Links to some useful online lectures:

- nptel.ac.in/courses/105107122/modules/module1/htmlpage/6(1).htm

21-30	TB1 13.1 - 13.18	**Module -3: Introduction to Field Astronomy:** Earth, celestial sphere, earth and celestial coordinate systems, spherical triangle, astronomical triangle, Napier's rule	Chalk and Talk Video Lectures for some topics	20

Links to some useful online lectures:

- nptel.ac.in/courses/105107122/25
  nptel.ac.in/courses/105107122/27

31-40	TB1 14.1- 14.31	**Module -4: Aerial Photogrammetry** Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problems), Ground Co-ordinates (simple problems), Relief Displacements (Derivation), Ground control, Procedure of aerial survey, overlaps and mosaics, Stereoscopes, Derivation Parallax(Derivation) .	Chalk and Talk Video Lectures for some topics	20

Links to some useful online lectures:

- nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/.../ui/Course_homeC_29.htm
  nptel.ac.in/courses/105104100/20

41-50	TB1 15.1 - 15.11 16.1-16.9	**Module -5: Modern Surveying Instruments** Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station, Lidar scanners for topographical survey. Remote Sensing: Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation. Digital image processing, Global Positioning system Geographical Information System: Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning).	Chalk and Talk	10

Links to some useful online lectures:

- nptel.ac.in/courses/105107121/
- www.nptelvideos.in/2012/11/modern-surveying-techniques.html

Text Books	
1.	B.C. Punmia, "Surveying Vol.2", Laxmi Publications pvt. Ltd., New Delhi.
2	Kanetkar T P and S V Kulkarni , Surveying and Levelling Part 2, Pune Vidyarthi GrihaPrakashan,
3.	K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi.
4.	Sateesh Gopi, Global Positioning System, Tata McGraw Hill Publishing Co. Ltd. New Delhi
Reference Books	
1.	S.K. Duggal, "Surveying Vol.I & II", Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2.	R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi.
3.	David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBS publishers
4.	B Bhatia, Remote Sensing and GIS, Oxford University Press, New Delhi.
5.	T.M Lillesand,.R.W Kiefer, and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and Sons India

Syllabus for Internal Assessment Tests (IAT)*

IAT #	Syllabus
IAT-1	Class # 01 – 18
IAT-2	Class # 19– 37
IAT-3	Class # 38– 52

*: See calendar of events for the schedules of IATs.

Course Outcomes
By the end of this course, students will be able to
1. Apply the knowledge of geometric principles to arrive at surveying problems
2. Use modern instruments to obtain geo-spatial data and analyse the same to appropriate engineering problems.
3. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments;
4. Design and implement the different types of curves for deviating type of alignments.

CORRELATION LEVELS	
0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

Course Outcomes		Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Apply the knowledge of geometric principles to arrive at surveying problems	**1,4**	2	2	1	1	-	1	-	-	-	-	-	1	1	-	1	-
CO2	Use modern instruments to obtain geo-spatial data and analyze the same to appropriate engineering problems.	**2,5**	2	3	-	1	-	1	2	1	2	-	-	2	1	-	1	-
CO3	Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments;	**2,3**	2	3	2	2	2	2	1	-	1	-	-	1	1	-	1	-
CO4	Design and implement the different types of curves for deviating type of alignments.	**1,4**	1	2	1	-	2	1	-	-	-	-	-	1	1	-	1	-

Note: From time to time, assignments will be posted on

https://sites.google.com/a/cmrit.ac.in/gurprasad.h