SCHEME OF COURSE WORK

Course Details:

Course Title	**Transforms Techniques and Complex Variables**		
Course Code	**20BM1106**	**L T P C**	**: 3 0 0 3**
Program:	**B. Tech.**		
Specialization:	**CIVIL Engineering**		
Semester	**III Semester**		

Course Outcomes (COs):

1	Evaluate Fourier series and Fourier transform of a function.
2	Solve partial differential equations, heat flow and wave propagation problems
3	Discuss the Z- transform technique and use it to solve difference equations
4	Examine continuity, differentiability and analyticity of a complex valued function
5	Evaluate the integral of a complex function over a simple closed contour

PROGRAM OUTCOMES:

1. Graduates will be able to apply the knowledge of mathematics, science, engineering fundamentals to solve complex civil engineering problems.
2. Graduates will attain the capability to identify, formulate and analyse problems related to civil engineering and substantiate the conclusions
3. Graduates will be in a position to design solutions for civil engineering problems and design system components and processes that meet the specified needs with appropriate consideration to public health and safety.
4. Graduates will be able to perform analysis and interpretation of data by using research methods such as design of experiments to synthesize the information and to provide valid conclusions.
5. Graduates will be able to select and apply appropriate techniques from the available resources and modern civil engineering and software tools, and will be able to predict and model complex engineering activities with an understanding of the practical limitations.
6. Graduates will be able to carry out their professional practice in civil engineering by appropriately considering and weighing the issues related to society and culture and the consequent responsibilities.
7. Graduates will be able to understand the impact of the professional engineering solutions on environmental safety and legal issues.
8. Graduates will transform into responsible citizens by resorting to professional ethics and norms of the engineering practice.
9. Graduates will be able to function effectively in individual capacity as well as a member in diverse teams and in multidisciplinary streams.
10. Graduates will be able to communicate fluently on complex engineering activities with the engineering community and society, and will be able to prepare reports and make presentations effectively.
11. Graduates will be able to demonstrate knowledge and understanding of the engineering and management principles and apply the same while managing projects in multidisciplinary environments.
12. Graduates will engage themselves in independent and life-long learning in the broadest context of technological change while continuing professional practice in their specialized areas of civil engineering.

Course Outcome versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	3										
CO-2	3	2										
CO-3	3	3										
CO-4	3	3										
CO-5	3	3										

3 - Strongly correlated, *2* - *Moderately* correlated, *0* - *No correlation*

Program Specific Objectives (PSOs): The student must attain the knowledge and skills to

PSO-1	Collect, process and analyse the data from topographic surveys, remote sensing, hydrogeological investigations, geotechnical explorations, and integrate the data for planning of civil engineering infrastructure.
PSO-2	Analyse and design of substructures and superstructure for buildings, bridges, irrigation structures and pavements.
PSO-3	Estimate, cost evaluation, execution and management of civil engineering projects. With Regards

Course Outcome Versus Program Specific Outcomes:

COs	PSO1	PSO2	PSO3
CO-1	2	1	2
CO-2	2	1	2
CO-3	2	1	2
CO-4	2	1	2
CO-5	2	1	2

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), put -: No Correlation

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	Dirichlet's conditions, Fourier series, conditions for a Fourier expansion, functions of any period	CO-I	Determine the Fourier series of $f(x)=x$ in $(0,2\pi)$.	Lecture / Problem solving	Assignment (Week 2 - 4) / Mid-Test 1 (Week 9)
2	Fourier series of odd and even functions - half range series	CO-I	Determine the Fourier sine series of $f(x)=2-x$ in $(0,\pi)$.	Lecture / Problem solving	Assignment (Week 2 - 4) / Mid-Test 1 (Week 9)
3	Fourier integrals, Fourier cosine and sine integrals, Fourier transform	CO-I	Determine the Fourier transform of $f(x)=\begin{cases} x \text{ in } (-1,1) \\ 0, \text{ elsewhere} \end{cases}$.	Lecture / Problem solving	Assignment (Week 2 - 4) / Mid-Test 1 (Week 9)
4	Fourier sine and Fourier cosine transforms and properties, convolution theorem (without proof).	CO-I	Determine the Fourier since transform of $f(x)=e^{-x}$.	Lecture / Problem solving	Assignment (Week 2 - 4) / Mid-Test 1 (Week 9)
5	First order partial differential equations	CO-II	Determine the partial differential equation corresponding to $z=ax+by$.	Lecture / Problem solving	Mid-Test 1 (Week 9) / Quiz
6	Solutions of first order linear and nonlinear PDEs	CO-II	Solve $p+q=1$.	Lecture / Problem solving	Mid-Test 1 (Week 9)/ Quiz
7	Method of Separation of variables	CO-II	Solve by the method of separation of variables $2x\frac{\partial z}{\partial x}-3y\frac{\partial z}{\partial y}=0$	Lecture / Problem solving	Mid-Test 1 (Week 9) / Quiz
8	Solutions of wave, heat and Laplace equations	CO-II	Solve one dimensional wave equation $\frac{\partial^2 y}{\partial x^2}=\frac{1}{c^2}\frac{\partial^2 y}{\partial x^2}$	Lecture / Problem solving	Mid-Test 2 (Week 10) / Quiz
9	**Mid Exam-I**				
10	Definition of Z-transform, elementary properties, linearity property	CO-III	Apply the Z-transform to $a_n=n$.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Assignment (12-14)
11	damping rule, shifting to the right and left, multiplication by *n*	CO-III	Apply the Z-transform to $a_n=a^n n$.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Assignment (12-14)
12	initial value theorem, final value	CO-III	Determine the inverse Z-transform	Lecture / Problem	Mid-Test 2 (Week 18) /

	theorem, inverse Z-transform, convolution theorem (without proof).		of $\frac{z}{(z-1)(z-2)}$.	solving	Assignment (12-14)
13	Continuity, differentiation, Cauchy-Riemann equations, analytic functions,	CO-IV	Examine the analyticity of $f(z)=\bar{z}$.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Assignment (12-14)
14	harmonic functions, finding harmonic conjugate.	CO-IV	Determine the harmonic conjugate of $u=x^2-y^2$.	Lecture / Problem solving	Mid-Test 2 (Week 18)/ Quiz
15	Contour integrals, Cauchy's theorem (without proof), Cauchy's integral formula (without proof),	CO-V	Evaluate the integral $\oint_{C:\lvert z\rvert=3} \frac{z}{(z-1)(z-2)}dz$.	Lecture / Problem solving	Mid-Test 2 (Week 18)/ Quiz
16	Taylor's series, zeros of analytic functions, singularities, Laurent's series, residues	CO-V	Determine the Laurent's series of $f(z)=\frac{1}{(z-1)(z+2)}$ in $0<\lvert z\rvert<1$.		Mid-Test 2 (Week 18)/ Quiz
17	Cauchy residue theorem (without proof)	CO-V	Evaluate $\oint_c \frac{\sin \pi z^2+\cos \pi z^2}{(z-1)^2(z-2)}dz$ where C is the circle $\lvert z\rvert=3$ using residue theorem		Mid-Test 2 (Week 18)
18	**Mid Exam-II**				
19/20	**END EXAM**				