INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous) Dundigal, Hyderabad -500 043

CIVIL ENGINEERING

TUTORIAL QUESTION BANK

Course Name		Mathematical Transform Techniques
Course Code	••	AHS011
Class	:	B. Tech IV Semester
Branch	:	Civil Engineering
Year	:	2018 - 2019
Course Coordinator	:	Ms. B Praveena, Assistant Professor, FE
Course Faculty	:	Dr. S Jagadha, Associate Professor, FE Ms.V Subba laxmi, Assistant Professor, FE

I. COURSE OBJECTIVES (COs):

The course should enable the students to:

Ι	Express non periodic function to periodic function using Fourier series and Fourier transforms.
II	Apply Laplace transforms and Z-transforms to solve differential equations.
III	Formulate and solve partial differential equations.

II. COURSE LEARNING OUTCOMES (CLOs):

Students, who complete the course, will have demonstrated the ability to do the following:

CAHS011.01	Ability to compute the Fourier series of the function with one variable.
CAHS011.02	Understand the nature of the Fourier series that represent even and odd functions.
CAHS011.03	Determine Half- range Fourier sine and cosine expansions.
CAHS011.04	Understand the concept of Fourier series to the real-world problems of signal processing
CAHS011.05	Understand the nature of the Fourier integral.
CAHS011.06	Ability to compute the Fourier transforms of the function.
CAHS011.07	Evaluate finite and infinite Fourier transforms.
CAUS011.08	Understand the concept of Fourier transforms to the real-world problems of circuit analysis,
CAIIS011.00	control system design
CAHS011.09	Solving Laplace transforms using integrals.
CAHS011.10	Evaluate inverse of Laplace transforms by the method of convolution.
CAHS011.11	Solving the linear differential equations using Laplace transform.
CAHS011 12	Understand the concept of Laplace transforms to the real-world problems of electrical
CAIIS011.12	circuits, harmonic oscillators, optical devices, and mechanical systems
CAHS011.13	Apply Z-transforms for discrete functions.
CAHS011 14	Evaluate inverse of Z-transforms using the methods of partial fractions and convolution
CAII5011.14	method.
CAHS011.15	Apply Z-transforms to solve the difference equations.
CAHS011 16	Understand the concept of Z-transforms to the real-world problems of automatic controls in
CAIIS011.10	telecommunication.
CAHS011.17	Understand partial differential equation for solving linear equations by Lagrange method.
CAHS011.18	Apply the partial differential equation for solving non-linear equations by Charpit's method.



CAHS011.19	Solving the heat equation and wave equation in subject to boundary conditions.			
CAUSO11 20	Understand the concept of partial differential equations to the real-world problems of			
CAII5011.20	electromagnetic and fluid dynamics			
CAUSO11 21	Possess the knowledge and skills for employability and to succeed in national and			
САПЗОП1.21	international level competitive examinations.			

TUTORIAL QUESTION BANK

	UNIT - I				
	FOURIER SERIES				
Part -	A (Short Answer Questions)		1		
S No	QUESTIONS	Blooms Taxonomy Level	Course Learning Outcomes (CLOs)		
1	Define a periodic function for the function $f(x)$ and give example.	Remember	CAHS011.01		
2	Define even and odd function the function $f(x)$.	Remember	CAHS011.01		
3	Find whether the following functions are even or odd (i) $x \sin x + \cos x + x^2 \cosh x$ (ii) $x \cosh x + x^3 \sinh x$.	Understand	CAHS011.01		
4	Find the primitive periods of the functions sin3x, tan5x, sec4x	Understand	CAHS011.01		
5	Write Euler's formulae in the interval $(\alpha, \alpha + 2\pi)$.	Remember	CAHS011.01		
6	Write the half range Fourier sin and cosine series in $(0, l)$.	Understand	CAHS011.01		
7	Write the examples of periodic function.	Understand	CAHS011.01		
8	Express $f(x) = \frac{\pi^2}{12} - \frac{x^2}{4}$ as a Fourier series in the interval $-\pi < x < \pi$.	Understand	CAHS011.01		
9	Write the Dirichlet's conditions for the existence of Fourier series of a function $f(x)$ in the interval $(\alpha, \alpha + 2\pi)$.	Remember	CAHS011.01		
10	If $f(x) = x$ in $(-\pi, \pi)$ then find the Fourier coefficient a_2 ?	Understand	CAHS011.01		
11	What are the conditions for expansion of a function in Fourier series?	Understand	CAHS011.01		
12	If $f(x)$ is an odd function in the interval $(-l, l)$ then what are the value of a_0, a_n ?	Understand	CAHS011.01		
13	If $f(x) = x^2$ in $(-l, l)$ then find b_1 ?	Understand	CAHS011.01		
14	What is the Fourier sine series for $f(x) = x$ in $(0, \pi)$?	Understand	CAHS011.01		
15	What is the half range sine series for $f(x) = e^x$ in $(0, \pi)$?	Understand	CAHS011.0		
16	Define fourier series of a function $f(x)$ in the interval (C, C +2 π)?	Remember	CAHS011.01		
17	Define fourier series of a function $f(x)$ in the interval $(-l, l)$?	Remember	CAHS011.01		
18	If $f(x) = x^2 - x$ in $(-\pi, \pi)$ then what is a_0 ?	Understand	CAHS011.01		
19	Write the fourier series for even function?	Understand	CAHS011.01		
20	Write the fourier series for odd function?	Understand	CAHS011.01		
Part -	B (Long Answer Questions)		1		
1	Obtain the Fourier series expansion of f(x) given that $f(x) = (\pi - x)^2$ in $0 < x < 2\pi$ and deduce the value of $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$	Understand	CAHS011.0 CAHS011.01		
2	Find the Fourier Series to represent the function $f(x) = \sin x $ in $-\pi < x < \pi$.	Understand	CAHS011.01		

3	Find the Fourier Series expansion for the function $f(x) = x$ in the interval	Understand	CAHS011.01
	$(-\pi,\pi)$.		
4	Find the Fourier Series expansion for the function $f(x) = \cos x $ in	Understand	CAHS011.01
	$\left[-\pi,\pi\right]$.		
5	Find the Fourier series to represent the function $f(x) = e^{ax}$ in	Understand	CAHS011.01
	$0 < x < 2\pi$		
6	Find the half range Fourier sine series for the function $f(x) = \cos x$ for	Understand	CAHS011.02
	$0 < x < \pi$		
7	Obtain the Fourier cosine series for $f(x) = x \sin x$ when $0 < x < \pi$ and	Understand	CAHS011.01
	show that		
	$\left \frac{1}{13} - \frac{1}{35} + \frac{1}{57} - \frac{1}{79} + \dots \right = \frac{\pi - 2}{4}.$		
8	Find the Fourier series to represent the function $f(x) = x \cos x$ in	Understand	CAHS011.01
	$0 < x < 2\pi$		
9	If $f(x)$ = coshax then expand $f(x)$ as a Fourier Series in the interval	Understand	CAHS011.01
	$(-\pi,\pi)$.		
10	Find the Fourier cosine and sine series for the function	Understand	CAHS011.02
	$f(x) = \frac{1}{\pi} (3x^2 - 6x\pi + 2\pi^2)$ in the interval $(0, 2\pi)$.		
11		Understand	CAUS011.01
11	Express the function $f(x) = x - \pi$ as Fourier series in the interval	Understand	CAIIS011.01
10	$-\pi < x < \pi$		GAUG011.01
12	Find the Fourier series to represent the function $f(x) = e^{-ax}$ from	Understand	CAHS011.01
	$x = -\pi$ to π . And hence deduce that		
	$\left \frac{\pi}{2} = 2 \right \frac{1}{2} - \frac{1}{2} + \frac{1}{2} - \frac{1}{2} - \frac{1}{2} + \frac{1}{2} - \frac{1}{2} - \frac{1}{2} + \frac{1}{2} - \frac{1}{2$		
	$\sinh \pi$ $\begin{bmatrix} 2^2 + 1 & 3^2 + 1 & 4^2 + 1 \end{bmatrix}$		
13	Expand the function $f(x) = \left(\frac{\pi}{x} - x\right)^2$ as a Fourier series in the interval	Understand	CAHS011.01
	Expand the function $f(x) = \left(\frac{-2}{2}\right)^{-1}$ as a Fourier series in the interval		
	$0 < \pi < 2\pi$ have deduce that $1 1 1 1 \pi^2$		
	$0 < x < 2\pi$, hence deduce that $\frac{1^2}{1^2} - \frac{1^2}{2^2} + \frac{1^2}{3^2} - \frac{1^2}{4^2} + \dots = \frac{1^2}{12}$		
14	Find the Fourier series to represent the function $f(x) = x - x^2$ in	Understand	CAHS011.01
	$[-\pi,\pi]?$		
15	Find the half range sine series for $f(x) = x(\pi - x)$, in $0 < x < \pi$	Understand	CAHS011.02
	Deduce that $\frac{1}{2} - \frac{1}{2} + \frac{1}{2} - \frac{1}{2} + = \frac{\pi^3}{2}$		
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		
16	Express $f(x) = e^{-x}$ as a Fourier series in the interval $(-l, l)$	Understand	CAHS011.01
17	Find the Fourier series of periodicity 3 for the function $f(x) = 2x - x^2$	Understand	CAHS011.01
	in (0,3)		~
10	Find the Fourier expansion of $f(x) - \frac{\pi^2}{2} - \frac{x^2}{2}$ in the interval $[-\pi, \pi]$	Understand	CAHS011.01
10	12 4		
10		That i i	CAUG011.02
19	Find the nall – range Fourier cosine series for the function	Understand	CAHS011.02

	$f(x) = \sin\left(\frac{\pi x}{l}\right)$ in the range $0 < x < l$		
20	Find the half- range Fourier sine series for the function	Understand	CAHS011.02
	$f(x) = \frac{e^{ax} - e^{-ax}}{e^{a\pi} - e^{-a\pi}} in \ (0,\pi)$		
Part -	C (Problem Solving and Critical Thinking Questions)		
1		Understand	CAHS011.02
	If $f(x) = \begin{cases} x, 0 < x < \frac{\pi}{2} \\ \pi \end{cases}$ then prove that		
	$\left(\pi - x, \frac{\pi}{2} < x < \pi\right)$		
	$f(x) = \frac{4}{\pi} \left[\sin x - \frac{1}{3^2} \sin 3x + \frac{1}{5^2} \sin 5x \right].$		
2	Find the Fourier series of the periodic function defined as $f(x) =$	Understand	CAHS011.02
	$\begin{bmatrix} -\pi, & -\pi < x < 0 \\ x & 0 < x < \pi \end{bmatrix}$		
	$1 1 1 \pi^2$		
	Hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + = \frac{1}{8}$		
3	The intensity of an alternating current after passing through a rectifier is	Understand	CAHS011.02
	given by $i(x) = \int I_0 \sin x \text{ for } 0 \le x \le \pi$ where I is the maximum		
	given by $t(x) = \begin{cases} 0 & \text{for } \pi \le x \le 2\pi \end{cases}$ where T_0 is the maximum		
	current and the period is 2π . Express $i(x)$ as a Fourier series.		
4	$\begin{bmatrix} 1 & 2x \\ 2x & 7 \leq x \leq 0 \end{bmatrix}$	Understand	CAHS011.02
	$\lim_{x \to \infty} f(x) = \int_{-\pi}^{1+\frac{\pi}{2}} \frac{\pi}{\pi}, -\pi \le x \le 0$		
	$\left[1 - \frac{2x}{x}\right] = 0 \le x \le \pi$		
	$\begin{bmatrix} 1 & -\pi, & 0 \leq x \leq \pi \\ \pi, & \pi \end{bmatrix}$		
	Then find the values of a_0, a_n and b_n ?		
5	$\int 0 \qquad l < r < -l$	Understand	CAHS011.02
	$0, -i < x < \frac{1}{2}$		
	If $f(x) = \begin{cases} \cos \frac{\pi x}{l} , \frac{-l}{2} < x < \frac{l}{2} \end{cases}$		
	0, $\frac{l}{2} < x < l$		
	in the Fourier expansion of $f(x)$ find the value of a_0, a_1 and b_1 ?		
6	$(-k \text{for} -\pi < r < 0)$	Understand	CAHS011.02
	Obtain the Fourier series of $f(x) = \begin{cases} k & \text{for } n < x < 0 \\ k & \text{for } 0 < x < \pi \end{cases}$ and hence		
	show that $1 - \frac{1}{2} + \frac{1}{5} - \frac{1}{7} + \dots = \frac{\pi}{4}$		
7	Determine the Fourier series representation of the half wave rectifier signal	Understand	CAHS011.02
	$r(t) = \int \sin t, 0 \le t < \pi$		
	$\int \left(0 \right)^{-} \left(0 \right)^{-} $, $\pi \le t < 2\pi$		

8	$\int t = 0 \le t \le 1$	Understand	CAHS011.02
	Let $x(t) = \begin{cases} t & t \\ 0 & t \\$		
	$\begin{bmatrix} 2-t & , & 1 \le t \le 2 \end{bmatrix}$		
	period T=2, Find the Fourier coefficients a_0 , a_n and b_n ?		
9	$(\pi - \mathbf{r})^2$	Understand	CAHS011.01
	In the expansion of $f(x) = \left(\frac{\pi - x}{2}\right)$, $0 < x < 2\pi$ find the value of		
	a_n and b_n .?		
10	Obtain the Fourier series for the function	Understand	CAHS011.02
	$\int x \qquad in -\pi < x < \pi$		
	$f(x) = \begin{cases} 0 & in 0 < x < \pi/2 \end{cases}$		
	$x - \pi/2$ in $\pi/2 < x < \pi$		
	EOUDIED TRANSFORMS		
Part_	A (Short Answer Questions)		
1	Write the Fourier sine integral and cosine integral	Remember	CAHS011.03
2	Find the Fourier sine transform of xe^{-ax}	Understand	CAHS011.03
-	Find the Fourier sine transform of $f(x)$	Domomhor	
3	Write the properties of Equiprocessform of $f(x)$.	Remember	CAHS011.03
+ 5	Find the Fourier sine transform of $f(x) = x^2$	Understand	CAHS011.03
6	Find the Fourier assing transform of $f(x) = 2e^{-5x} + 5e^{-2x}$	Understand	CAHS011.03
7	Find the Fourier cosine transform of $f(x) = 2e^{-x} + 3e^{-x}$	Understand	
/	What is the value of $F_C \{e^{-at}\}$?		CAH5011.05
8	State Fourier integral theorem.	Understand	CAHS011.03
9	Define Fourier transform.	Remember	CAHS011.03
10	Find the finite Fourier cosine transform of $f(x)=1$ in $0 < x < \pi$	Understand	CAHS011.03
11	Find the inverse finite sine transform f(x) if $F_s(n) = \frac{1 - \cos n\pi}{n^2 \pi^2}$	Understand	CAHS011.03
12	State and prove Linear property of Fourier Transform	Understand	CAHS011.03
13	State and prove change of scale property of Fourier Transform	Understand	CAHS011.03
14	State and prove Shifting Property of Fourier Transform	Understand	CAHS011.03
15	State and prove Modulation Theorem of Fourier Transform	Understand	CAHS011.03
16	Prove that $F(x^n f(x)) = (-i)^n \frac{d^n}{d} [F(p)]$	Understand	CAHS011.03
10	ds^n		
17	Find the Fourier Transform of $f(x)$ defined by	Understand	CAHS011.03
	$e^{iqx}, \alpha < x < \beta$ $(e^{ikx}, a < x < b)$		
	$f(x) = \begin{cases} 0, & x < \alpha \text{ and } x > \beta \end{cases} \text{ or } f(x) = \begin{cases} 0, & x < \alpha \text{ and } x > b \end{cases}$		
18	Solve $F_{a} \{ f(x) \cos ax \} = \frac{1}{2} [F_{a}(n+a) + F_{a}(n-a)]$	Understand	CAHS011.03
	2 2 2		
19	Solve $F \{ f(x) \sin ax \} = \frac{1}{2} [F(x+a) - F(x-a)]$	Understand	CAHS011.03
	$2^{\left[\Gamma_{S}(p+u) - \Gamma_{S}(p-u)\right]}$		

20	Solve $F_{s}{f(x)\sin ax} = \frac{1}{2}[F_{c}(p-a) - F_{c}(p+a)]$	Understand	CAHS011.03
Part -	B (Long Answer Questions)		
1	Find the Fourier transform of f(x) defined by $f(x) = \begin{cases} 1, & x < a \\ 0, & x > a \end{cases}$ and	Understand	CAHS011.03
	hence evaluate		
	$\int_0^\infty \frac{\sin p}{p} dp. and \int_{-\infty}^\infty \frac{\sin ap. \cos px}{p} dp$		
2	Find the Fourier transform of f(x) defined by $f(x) = \begin{cases} 1 - x^2, & x \le 1 \\ 0, & x > 1 \end{cases}$	Understand	CAHS011.03
	Hence evaluate		
	(i) $\int_0^\infty \frac{x \cos x - \sin x}{x^3} \cos \frac{x}{2} dx$ (ii) $\int_0^\infty \frac{x \cos x - \sin x}{x^3} dx$		
3	Find the Fourier Transform of f(x) defined by $f(x) = e^{\frac{-x^2}{2}}, -\infty < x < \infty$	Understand	CAHS011.03
	or Show that the Equiprocent Transform of $a^{\frac{-x^2}{2}}$ is reciproced		
4	or, show that the Fourier Transform of e is recipiocal.	The denotes a d	CAUS011.02
4	Find Fourier cosine and sine transforms of e^{-ax} , $a > 0$ and hence deduce	Understand	CAH5011.05
	the inversion formula (or) deduce the integrals		
	$i. \int_0^\infty \frac{\cos px}{a^2 + p^2} dp ii. \int_0^\infty \frac{p \sin px}{a^2 + p^2} dp$		
5	Find the Fourier sine Transform of $e^{- x }$ and hence evaluate	Understand	CAHS011.03
	$\int_0^\infty \frac{x \sin mx}{1+x^2} dx$		
6	Find the Fourier cosine transform of (a) $e^{-ax} \cos ax$ (b) $e^{-ax} \sin ax$	Understand	CAHS011.03
7	Find the Fourier sine and cosine transform of xe^{-ax}	Understand	CAHS011.03
8	Find the Fourier sine transform of $\frac{x}{a^2 + x^2}$ and Fourier cosine transform	Understand	CAHS011.03
	of $\frac{1}{a^2 + x^2}$		
9	Find the Fourier sine and cosine transform of $f(x) = \frac{e^{-ax}}{x}$ and deduce	Understand	CAHS011.03
	that $\int_0^\infty \frac{e^{-ax} - e^{-bx}}{x} \sin sx dx = Tan^{-1} \left(\frac{s}{a}\right) - Tan^{-1} \left(\frac{s}{b}\right)$		

10	Find the finite Fourier sine and cosine transform of $f(x)$, defined by	Understand	CAHS011.04	
	$f(x) = \left(1 - \frac{x}{\pi}\right)^2$, where $0 < x < \pi$			
11	Find the finite Fourier sine and cosine transform of $f(x)$, defined by	Understand	CAHS011.04	
	$f(x) = \sin ax \text{ in } (0, \pi).$			
12	Find the finite Fourier sine transform of $f(x)$, defined by	Understand	CAHS011.04	
	$f(x) = \begin{cases} x, & 0 \le x \le \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} \le x \le \pi \end{cases}$			
13	Using Fourier integral show that $e^{-x} \cos x = \frac{2}{\pi} \int_{0}^{\infty} \frac{\lambda^{2} + 2}{\lambda^{2} + 4} \cos \lambda x dx$	Understand	CAHS011.03	
14	Find the inverse Fourier transform $f(x)$ of $F(p) = e^{- p y}$	Understand	CAHS011.03	
15	Find the Fourier transform of $f(x) = \begin{cases} a^2 - x^2 & \text{if } x < a \\ 0 & \text{if } x > a \end{cases}$ hence show that	Understand	CAHS011.03	
	$\int_{0}^{\infty} \frac{\sin x - \cos x}{x^3} dx = \frac{\pi}{4}$			
16	Find the finite Fourier sine and cosine transforms of $f(x) = \sin ax$ in (0,	Understand	CAHS011.04	
17	π). Find the inverse Fourier cosine transform $f(x)$ of $F_c(p) = p^n e^{-ap}$ and	Understand	CAHS011.03	
	inverse Fourier sine transform $f(x)$ of $F_s(p) = \frac{p}{1+p^2}$			
18	Using Fourier integral show that	Understand	CAHS011.03	
	$e^{-ax} = \frac{2a}{\pi} \int_{0}^{\infty} \frac{\cos \lambda x}{\lambda^{2} + a^{2}} d\lambda (a > 0, x \ge 0)$			
19	Using Fourier integral show that	Understand	CAHS011.03	
	$e^{-ax} - e^{-bx} = \frac{2(b^2 - a^2)}{\pi} \int_0^\infty \frac{\lambda \sin \lambda x}{(\lambda^2 + a^2)(\lambda^2 + b^2)} d\lambda, a > 0, b > 0$			
20	Using Fourier Integral, show that	Understand	CAHS011.03	
	$\int_{0}^{\infty} \frac{1 - \cos \lambda \pi}{\lambda} . \sin \lambda x d\lambda = \begin{cases} \frac{\pi}{2} if 0 < x < \pi \\ 0, if x > \pi \end{cases}$			

	Part - C (Problem Solving and Critical Thinking Questions)				
1	Find the Fourier cosine transform of the function $f(x)$ defined by	Understand	CAHS011.03		
	$\int \cos x, 0 < x < a$				
	$\int f(x) = \begin{cases} 0, & x \ge a \end{cases}$				
2	Find the Fourier sine transform of $f(x)$ defined by	Understand	CAHS011.03		
		Chaoistana	C/1115011.05		
	$f(x) = \begin{cases} \sin x, & 0 < x < a \\ 0, & \infty \end{cases}$				
	$(0, x \ge a)$				
3	Find the Fourier sine and cosine transform of $2e^{-5x} + 5e^{-2x}$	Understand	CAHS011.03		
4	Find the Fourier sine and cosine transform of	Understand	CAHS011.03		
	$\begin{cases} x, & for 0 < x < 1 \end{cases}$				
	$f(x) = \begin{cases} 2-x, & \text{for } 1 < x < 2 \end{cases}$				
	0, for x > 2				
5	Find the Fourier cosine transform of $f(x)$ defined by	Understand	CAHS011.03		
	$\left(x, 0 < x < 1 \right)$				
	$f(x) = \begin{cases} 2-x, & 1 < x < 2 \end{cases}$				
	0, x > 2				
6	Find the inverse finite sine transform $f(x)$ if	Understand	CAHS011.04		
	$-()$ $1-\cos n\pi$				
	$F_s(n) = \frac{1}{n^2 \pi^2} \text{ where } 0 < x < \pi$				
7	Find the inverse finite cosine transform f(x), if	Understand	CAHS011.04		
	$(2n\pi)$				
	$E(n) = \frac{\cos\left(\frac{3}{3}\right)}{\cos\left(\frac{3}{3}\right)} \text{ where } 0 < x < 4$				
	$T_{c}(n) = \frac{1}{(2n+1)^{2}}, \text{ where } 0 < x < 4$				
		Understand	CAHS011.03		
8	Using Fourier integral show that	Understand	CAID011.05		
	$a^{-ax} \cos x = 2 \int_{1}^{\infty} \lambda^2 + 2 \cos \lambda x d\lambda$				
	$e^{-\cos x - \frac{1}{\pi} \int_{0}^{0} \frac{1}{\lambda^{2} + 4} \cos \lambda d\lambda}$				
9	Find the finite Fourier sine and cosine transforms of	Understand	CAHS011.04		
10	$f(x) = x(\pi - x) \text{ in } (0, \pi).$	XX 1 / 1	G + 110011 0 4		
10	Find the finite Fourier sine and cosine transforms of $f(x) = \cos ax$ in (0,1) and (0, π)	Understand	CAHS011.04		
	LAPLACE TRANSFORMS				
Part	- A (Short Answer Questions)				
1	Define Laplace Transform, and write the sufficient conditions for the existence of Laplace Transform	Remember	CAHS011.05		
2	Verify whether the function $f(t)=t^3$ is exponential order and find its	Understand	CAHS011.05		
	transform.	D	GATIGO11.0-		
3	Find the Laplace transform of Dirac delta function	Kemember	CAHS011.05		

4	Find the Laplace transform of $ \sin \omega t , t \ge 0$	Understand	CAHS011.05
5	State and prove change of scale property of Laplace Transform.	Understand	CAHS011.05
6	Find the Laplace transform of $t^2u(t-2)$	Remember	CAHS011.05
7	Find $L\{g(t)\}$ where $g(t) = \begin{cases} \cos(t - \frac{2\pi}{3}), & \text{if } t > \frac{2\pi}{3} \\ 0, & \text{if } t < \frac{2\pi}{3} \end{cases}$	Understand	CAHS011.05
8	Find the Laplace transform of $f(t) = \begin{cases} \cos t, 0 < t < \pi \\ \sin t, t > \pi \end{cases}$	Understand	CAHS011.05
9	Find the Laplace transform of sinh t	Remember	CAHS011.05
10	Verify the initial and final value theorem for $e^{-t}(t+1)^2$	Remember	CAHS011.05
	CIE II		
11	Prove that if $L^{-1}{f(s)} = f(t)$ then $L^{-1}{\overline{f}^{n}(s)} = (-1)^{n} t^{n} f(t)$	Understand	CAHS011.05
12	Prove that if $L^{-1}{f(s)} = f(t)$ then $L^{-1}{\frac{f(s)}{s}} = \int_{0}^{t} f(u) du$	Understand	CAHS011.05
13	State and prove convolution theorem to find the inverse of Laplace transform	Understand	CAHS011.04
14	Find the inverse Laplace transform of $L^{-1}\left\{\frac{3s+7}{s^2-2s-2}\right\}$	Understand	CAHS011.05
15	Find the inverse Laplace transform of $L^{-1}\left\{\frac{s}{(s+1)^2(s^2+1)}\right\}$	Understand	CAHS011.05
16	Find the inverse Laplace transform of $\frac{s}{(s^2+1)(s^2+4)}$	Understand	CAHS011.05
17	Find the inverse Laplace transform of $\log\left(\frac{s+a}{s+b}\right)$	Remember	CAHS011.05
18	Find the inverse Laplace transform of $\frac{e^{-2s}}{(s+4)^3}$	Remember	CAHS011.05
19	Solve the following initial value problem by using Laplace transform $4y'' + \pi^2 y = 0$, $y(0) = 0$, $y'(0) = 0$	Understand	CAHS011.05
20	Solve the following initial value problem by using Laplace transform $y'' + 4y = \delta(t), y(0) = 0, y'(0) = 0$	Understand	CAHS011.05
Part	– B (Long Answer Questions)		
1	Using Laplace transform evaluate $\int_{0}^{\infty} \frac{e^{-t} - e^{-2t}}{t} dt$	Understand	CAHS011.05
2	Find the Laplace transform of $f(t) = (t+3)^2 e^t$	Understand	CAHS011.06
3	Find $L\left\{\frac{\cos 4t \sin 2t}{t}\right\}$	Understand	CAHS011.05
4	Find $L{\cosh at \sin bt}$	Understand	CAHS011.05
5	Find $L\{e^{-3t}\sinh 3t\}$	Understand	CAHS011.05
6	Find $L\{t\sin 3t\cos 2t\}$	Understand	CAHS011.06

7	Find the Laplace transform of $\frac{\cos 2t - \cos 3t}{t}$	Understand	CAHS011.06
8	Find the Laplace transform of $te^{2t} \sin 3t$	Understand	CAHS011.06
9	Find the Laplace transform of $\left\{\frac{1-\cos a t}{t}\right\}$	Understand	CAHS011.06
10	Find the Laplace transform of $\cos t \cos 2t \cos 3t$	Understand	CAHS011.05
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11	Find the inverse Laplace transform of $\frac{2S^2 - 6S + 5}{S^3 - 6S^2 + 11S - 6}$	Understand	CAHS011.05
12	Find the inverse Laplace transform $\frac{e^{-2s}}{s^2 + 4s + 5}$	Understand	CAHS011.05
13	Find the inverse Laplace transform $\frac{s}{(s^2+1)(s^2+9)(s^2+25)}$	Understand	CAHS011.05
14	Find the inverse Laplace transform of $\log\left(\frac{s^2+4}{s^2+9}\right)$	Understand	CAHS011.05
15	Find the inverse Laplace transform $\frac{s^2 + 2s - 4}{(s^2 + 9)(s - 5)}$	Understand	CAHS011.05
	Solve the following initial value problem by using Laplace transform	Understand	CAHS011.06
16	$(D^2 + 2D + 5)t = e^{-t}\sin t, y(0) = 0, y'(0) = 1$		
17	Solve the following initial value problem by using Laplace transform	Understand	CAHS011.06
	$y'' + 9y = \cos 2t, y(0) = 1, y(\frac{\pi}{2}) = -1$		
	Solve the following initial value problem by using Laplace transform	Understand	CAHS011.06
18	y''' - 2y'' + 5y' = 0, y(0) = 1, y'(0) = 0, y''(0) = 1		
19	Solve the following initial value problem by using Laplace transform	Understand	CAHS011.06
	$(D^3 - D^2 + 4D - 4)t = 68e^x \sin 2x, y = 1, Dy = -19, D^2y = -37$ at x=0		
20	Solve the following initial value problem by using Laplace transform	Understand	CAHS011.06
	$\frac{dy}{dt} + 2y + \int_{0}^{t} y dt = \sin t, \ y(0) = 1$		
Part -	- C (Problem Solving and Critical Thinking)		
1	Using the theorem on transforms of derivatives, find the Laplace	Understand	CAHS011.05
	Transform of the following functions.		
	(a). e^{at} (b). cosat (c). t sin at		
2	Find the Laplace transform of (a) $e^{-3t} \cosh 4t \sin 3t$ (b) $(t+1)^2 e^t$	Understand	CAHS011.05
3	Find the Laplace transform of (a) $t^2 e^t \sin 4t$ (b) $t \cos^2 t$	Understand	CAHS011.05

4	Find the Laplace transform of $\int_{0}^{t} \frac{e^{t} \sin t}{t} dt$	Understand	CAHS011.06
5	Find the L{f(t)} and L{f'(t)} for the function (a) $\frac{\sin t}{t}$ (b) $e^{-5t} \sin t$	Understand	CAHS011.06
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6	Find the inverse Laplace transform $\frac{s+3}{s^2-10s+29}$	Understand	CAHS011.06
7	Find the inverse transform of $\frac{s+2}{s^2-4s+13}$	Understand	CAHS011.06
8	Find the inverse Laplace transform $\frac{s^2 + s - 2}{s(s+3)(s-2)}$	Understand	CAHS011.06
9	Apply convolution theorem to evaluate $L^{-1}\left\{\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right\}$	Understand	CAHS011.06
10	Apply convolution theorem to evaluate $L^{-1}\left\{\frac{1}{s(s^2+4)^2}\right\}$	Understand	CAHS011.06
	UNIT-IV		
	Z – TRANSFORMS		
Part – 1	Prove that $z(a^n) = \frac{z}{z-a}$	Understand	CAHS011.07
2	Evaluate $z \left[\frac{1}{(n+1)!} \right]$	Understand	CAHS011.07
3	Find the z- transform of $e^{-\alpha n}$ where $\alpha > 0$	Understand	CAHS011.07
4	Find the z-transform of the sequence defined by $u_n = 2^n \ n \le 0$	Understand	CAHS011.07
5	State and prove Linear Properties of z- transforms	Understand	CAHS011.07
0	Find the z- transform of $\frac{a^n}{n!}e^{-a}$	Understand	CAHS011.07
7	Find the z- transform of $\cos(n+1)\theta$	Understand	CAHS011.07
8	State and prove shifting property to the right.	Understand	CAHS011.07
9	Prove that $z\left[\left(\frac{1}{2}\right)^n\right] = \frac{2z}{2z-1}$	Understand	CAHS011.07
10	State and prove shifting property to the left.	Understand	CAHS011.07
11	Find $z(n-1)^2$	Understand	CAHS011.07
12	Define convolution theorem of Z-Transform	Remember	CAHS011.07
13	Find $z(n\cos n\theta)$	Understand	CAHS011.07
14	Show that $z(\frac{1}{n+1}) = z \log \frac{z}{z-1}$	Understand	CAHS011.07

15	Evaluate the inverse z-transform of $\frac{4z}{z-1}$	Understand	CAHS011.07
16	Evaluate Inverse z-transform of $\frac{3z(z+1)}{(z-1)^3}$	Understand	CAHS011.07
17	Evaluate the inverse z-transform of $\frac{1}{1-az^{-1}}$ with $ z >a$	Understand	CAHS011.07
18	Obtain the z-transform of the cosine function $x(t) = \begin{cases} \cos \omega t & 0 \le t \\ 0 & t < 0 \end{cases}$	Understand	CAHS011.07
19	Prove that $z(n^2) = \frac{z^2 + z}{(z-1)^3}$	Understand	CAHS011.07
20	Find the z-Transform of $\frac{1}{n(n+1)}$	Understand	CAHS011.07
Part -	- B (Long Answer Questions)		
1	Evaluate $z(\cos\theta + i\sin\theta)^n$ hence prove that	Understand	CAHS011.07
	$z(\cos n\theta) = \frac{z(z - \cos \theta)}{z^2 - 2z\cos \theta + 1} \text{ and } z(\sin n\theta) = \frac{z\sin \theta}{z^2 - 2z\cos \theta + 1}$		
2	Find the inverse z-transform of $\frac{8z-z^3}{(4-z)^3}$	Understand	CAHS011.07
3	Use convolution theorem to evaluate $z^{-1}\left(\frac{z^2}{z^2-4z+3}\right)$	Understand	CAHS011.07
4	State and prove convolution theorem of z- transforms.	Understand	CAHS011.07
5	Obtain the inverse z-transform of $\frac{z^3}{(z+1)(z-1)^2}$	Understand	CAHS011.07
6	Obtain the inverse z-transform of $\frac{z-1}{(z-2)^3}$	Understand	CAHS011.07
7	Use convolution theorem to evaluate the inverse of $\frac{z^2}{z^2 - 5z + 6}$	Understand	CAHS011.07
8	Solve the difference equation using z-transform $y_{n+2}-3y_{n+1}+2y_n=4^n$ with $y_0=0, y_1=1$	Understand	CAHS011.07
9	Solve difference equation using z-transform u_{n+2} - $4u_{n+1}$ + $4u_n$ = 2^n given u_0 =0, u_1 =1	Understand	CAHS011.07
10	Solve the difference equation using z- transform $u_{n+2}-2u_{n+1}u_n=3n+5$	Understand	CAHS011.07
11	Solve the difference equation using z- transform $u_{n+2} - 8u_{n+1} + 16u_n = 4^n$ given $u_0=0$ and $u_1=1$	Understand	CAHS011.07
12	Solve the difference equation using z- transform $y_{n+2} - 2y_{n+1} + y_n = 2^n$ with $y_{n+2} = 2$ and $y_{n+1} = 1$	Understand	CAHS011.07
13	Solve the difference equation using z- transform	Understand	CAHS011.07
1.5	$y_{n+2} - 2y_{n+1} + y_n = 3n+5$ with $y_0=1$ and $y_1=3$	Chicobund	
14	Solve the difference equation using z- transform $u_{n+2} - 6u_{n+1} + 9u_n = 0$	Understand	CAHS011.07
15	Solve the difference equation using z- transform	Understand	CAHS011.07

	$y_{n+2} - 2y_{n+1} + y_n = 3n + 5$ with $y_0 = y_1 = 0$		
16	Evaluate $z^{-1}\left(\frac{4z^2-2z}{z^3-5z^2+8z-4}\right)$	Understand	CAHS011.07
17	Using $z(n^2) = \frac{z^2 + z}{(z-1)^3}$ prove that $z(n+1)^2 = \frac{z^3 + z^2}{(z-1)^3}$	Understand	CAHS011.07
18	Evaluation of inverse z-Transforms by using standard Formulae.	Understand	CAHS011.07
	$z^{-1}\left(\frac{az}{\left(z-a\right)^{2}}\right) = na^{n}$		
19	Prove that $z(a^n \sin n\theta) = \frac{az \sin \theta}{z^2 - 2az \cos \theta + a^2}$	Understand	CAHS011.07
20	Show that $z(\sin(n+1)\theta) = \frac{z^2 \sin \theta}{z^2 - 2z \cos \theta + 1}$	Understand	CAHS011.07
Part -	C (Problem Solving and Critical Thinking)		
1	Using the power series method find the inverse Z –Transform of	Understand	CAHS011.08
	$\frac{z}{(10+7z+z^2)}$		
2	Using the power series method find the inverse Z –Transform of	Understand	CAHS011.08
	Z		
	(z-3)(z-2)(z-1)		
3	Using the power series method find the inverse Z – Transform of $1 + 2 = 1$	Understand	CAHS011.08
	$\frac{1+2z}{(1+2z^{-1}+4z^{-2})}$		
4	Using convolution theorem to find the inverse Z –Transform of	Understand	CAHS011.08
	$\frac{10z}{z}$		
	$\frac{(z-2)(z-1)}{z}$		CAUG011.00
5	Using convolution theorem to find the inverse Z – I ransform of 0^{-2}	Understand	CAHS011.08
	$\frac{\delta z}{(4+1)(2-1)}$		
6	(4z+1)(2z-1) Using the partial fraction method find the inverse Z. Transform of	Understand	CAUS011.08
0	z(2z-1)	Understand	CAIIS011.00
	$\frac{z(z-z)}{(z-2)^2(z-1)}$		
7	Using the partial fraction method find the inverse Z – Transform of	Understand	CAHS011.08
	$z^{2} + 2z + 1$		
	$\frac{1}{2}$ 3 1		
	$z^{-}-\frac{1}{2}z^{+}+\frac{1}{2}$		
8	Using the partial fraction method find the inverse Z –Transform of	Understand	CAHS011.08
	$\underline{z^2}$		
	$(z^2+4)(z+2)$		
9	Using the integral method find the inverse Z – Transform of	Understand	CAHS011.08
	$\frac{z-4}{\sqrt{z-z}}$		
	$(z^2 + 5z + 6)$		

10	Using the partial fraction method find the inverse Z –Transform of	Understand	
	z(4z-2)		CAHS011.08
	$\frac{1}{(z-2)^2(z-1)}$		
	PARTIAL DIFFERENTIAL FOUNTIONS AND APPLIC	TIONS	
Part -	A (Short Answer Questions)		
1	Define order and degree with reference to partial differential equation	Remember	CAHS011.09
2	Form the partial differential equation by eliminate the arbitrary constants	Understand	CAHS011.09
	from $z = ax^3 + by^3$		
3	Form the partial differential equation by eliminating arbitrary function $z=f(x^2+y^2)$	Understand	CAHS011.09
4	Solve the partial differential equation $p\sqrt{x} + q\sqrt{y} = \sqrt{z}$	Understand	CAHS011.09
5	Define complete integral with reference to nonlinear partial differential equation	Remember	CAHS011.09
6	Define general integral with reference to nonlinear partial differential equation	Remember	CAHS011.09
7	Solve the partial differential equation $p^2 + q^2 = m^2$	Understand	CAHS011.09
8	Solve the partial differential equation $z = px+qy+p^2q^2$	Understand	CAHS011.09
9	Write the one dimension wave equation of partial differential equation	Remember	CAHS011.09
10	Write the one dimension heat equation of partial differential equation	Remember	CAHS011.09
11	Eliminate the arbitrary constants from $z=(x^2+a)(y^2+b)$ to form partial differential equation	Understand	CAHS011.09
12	Form the partial differential equation by eliminating a and b from $log(az-1) = x + ay + b$	Understand	CAHS011.09
13	Form the partial differential equation by eliminating the constants from	Understand	CAHS011.09
	$(x-a)^2 + (y-b)^2 = z^2 \cot^2 \alpha$ where α is a parameter.		
14	Define a non-linear partial differential equation.	Remember	CAHS011.09
15	Define particular integral with reference to nonlinear partial differential equation.	Remember	CAHS011.09
16	Define singular integral with reference to nonlinear partial differential equation	Remember	CAHS011.09
17	Solve p- $x^2=q+v^2$	Understand	CAHS011.09
18	Solve the partial differential equation $x(y-z)p+y(z-x)q=z(x-y)$.	Understand	CAHS011.09
19	Find a complete integral of $f=xpq+yq^2-1=0$.	Understand	CAHS011.09
20	Find a complete integral of $f = (p^2+q^2)y-qz=0$	Understand	CAHS011.09
Part -	B (Long Answer Questions)		
1	Form the partial differential equation by eliminating arbitrary function	Understand	CAHS011.09
	from $f(x^2 + y^2 + z^2, z^2 - 2xy) = 0$		
2	Solve the partial differential equation $p^2 z^2 \sin^2 x + q^2 z^2 \cos^2 y = 1$.	Understand	CAHS011.09
3	Solve the partial differential equation $x^2 p^2 + xpq = z^2$.	Understand	CAHS011.09
4	Solve the partial differential equation $q^2 - p = y - x$.	Understand	CAHS011.09
5	Solve the partial differential equation $px + qy = pq$	Understand	CAHS011.09
6	Form a partial differential equation by eliminating a, b, c from	Understand	CAHS011.09
	$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1.$		

7	Solve the partial differential equation	Understand	CAHS011.09
	$(x^{2} - yz)p + (y^{2} - zx)q = z^{2} - xy$		
8	Solve the partial differential equation	Understand	CAHS011.09
	$(z^{2}-2yz-y^{2})p + (xy+zx)q = xy-zx.$		
9	Solve the partial differential equation.	Understand	CAHS011.09
	(mz-ny)p+(nx-lz)q=(ly-mx).		
10	Solve the partial differential equation $y^2zp+x^2zq = xy^2$	Understand	CAHS011.09
11	Solve the partial differential equation $z(p^2 - q^2) = x - y$	Understand	CAHS011.09
12	$x^2 y^2$	Understand	CAHS011.09
	Solve the partial differential equation $-+ + - = z$ p = q		
13	$\frac{1}{p-x^2} = a + y^2$	Understand	CAHS011.09
14	Solve the partial differential equation $P = x^2 - q + y^2$.	Understand	CAUS011.00
14	Solve the partial differential equation $q = px + p^2$.	Understand	САНЗ011.09
15	Solve the partial differential equation $z^2 = pqxy$.	Understand	CAHS011.09
16	Solve the partial differential equation $z = p^2 x + q^2 y$	Understand	CAHS011.09
17	Find the differential equation of all spheres whose centres lie on z-axis	Understand	CAHS011.09
	with a given radius r.		
18	Find a complete integral of $2(z+xp+yq)=yp^2$	Understand	CAHS011.09
19	Solve the partial differential equation	Understand	CAHS011.09
	$(x^2 - y^2 - yz)p + (x^2 - y^2 - zx)q = z(x - y).$	** 1 1	G + 1100111 000
20	Solve the partial differential equation $(x^2-y^2-z^2)p+2xyq = 2xz$	Understand	CAHS011.09
Part -	- C (Problem Solving and Critical Thinking)	Understand	
1	Solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ where $u(x,0) = 6e^{-3x}$ by the method of separation	Onder stand	CAHS011.09
	of variables.		
2	Solve by the method of separation of variables $2xz_x - 3yz_y = 0$.	Understand	CAHS011.09
	$\partial^2 u$ ∂u	Understand	CAHS011.09
3	Solve $\frac{\partial x}{\partial t} = e^{-t} \cos x$ given that u=0 when t = 0 and $\frac{\partial x}{\partial t} = 0$ When		
	$x = 0$ show also that as t tends to ∞ , u tends to sin x.		
4	Solve by the method of separation of variables $2u_x + u_y = 3u$ and	Understand	CAHS011.09
	$u(0, y) = e^{-5y}$		
5	A tightly stretched string with fixed end points $x=0$ and $x=l$ is initially at	Understand	CAHS011.10
	rest its equilibrium position. If it is set to vibrate by giving each of its		
	points a velocity $\lambda x(1-x)$, find the displacement of the string at any		
	distance x from one end at any time t.		
6	Solve the one dimensional heat flow equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial r^2}$	Understand	CAHS011.10
	given that $u(0,t) = 0, u(L,t) = 0, t > 0$ and		
	$u(x,0) = 3\sin\left(\frac{\pi x}{L}\right), 0 < x < L.$		
1			

7	Derive the complete solution for the one dimensional heat equation with	Understand	CAHS011.10
	zero boundary problem with initial temperature $u(x,0) = x(L-x)$ in the		
	interval (0, L).		
8	Write the boundary conditions for a rectangular plate is bounded by the	Understand	CAHS011.10
	line x=0, y=0, x=a, and y=b its surface are insulated the temperature along		
	x=0 and y=0 are kept at 0° C and the other are kept at 100° C.		
9	a string is stretched and fastened to two points at x=0 and x=L.Motion is	Understand	CAHS011.10
	started by displacing the string into the form $y=k(lx-x^2)$ from which it is		
	released at time t=0. Find the displacement of any point on the string at a		
	distance of x from one end at time t		
10	A tightly stretched string with fixed end points $x=0$ and $x=l$ is initially in	Understand	CAHS011.10
	a position given by $y = y_0 \sin^3 \frac{\pi x}{l}$. If it is released from rest from this		
	position, find the displacement(x,t).		

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