INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

ASSIGNMENT

Course Name	:	**Engineering Mathematics –III**
Course Code	:	A30007
Class	:	II-I B. Tech
Branch	:	ECE,EEE
Year	:	2016 – 2017
Course Faculty	:	Mr. K Jagan Mohan Rao, Mr. Ch. Soma Shekar, Ms. V Subba Laxmi, Ms. C Rachana

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.
In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

S.No	QUESTION	Blooms Taxonomy Level	Course Outcome
	ASSIGNMENT – I (SHORT ANSWER TYPE QUESTIONS) Unit – I		
1	Solve$(x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y) = logx$.	Understand	a
2	Find the singular points of $x^2\, y'' + \, ax\, y' + by = 0$.	Analyse	b
3	Find the singular points of $x^2\, y'' + \, x\, y' + (x^2 - n^2)y = 0$.	Understand	b
4	Solve in series the equation $\frac{d^2y}{dx^2} - xy$ =0.	Understand	c
5	Find the singular points $(1 - x^2)y'' + 2xy' - y = 0$.	Understand	b
6	Find the singular points of$(1 - x^2)y'' - 2xy' + n(n+1)y = 0$.	Evaluate	b
7	Find the singular points of $x^3(x-2)\, y'' + \, x^3\, y' + 6y = 0$.	Evaluate	b
8	Find the singular points of $x^2\, y'' + \, (x + x^2)y' - y = 0$.	Evaluate	b
9	Find the singular points of $x^2\, y'' - 5y' + 3x^2y = 0$.	Understand	b
10	Solve in series the equation $y'' + \, x\, y' + y = 0 \; about\; x = 0$.	Analyse	c
	(LONG ANSWER QUESTIONS) UNIT-I		
1	Solve $(x^2D^2 - 4xD + 6\,)y \; = x^2$.	Apply	a
2	Solve $x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} + 2y = 10(x + \frac{1}{x})$.	Apply	a
3	Solve $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 4y = (1+x)^2$.	Evaluate	a
4	Solve$(x+1)^2\frac{d^2y}{dx^2} - 3(x+1)\frac{dy}{dx} + 4y = x^2$+ x+1.	Evaluate	a

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5	Solve $(2x-1)^3\frac{d^3y}{dx^3}+(2x-1)\frac{dy}{dx}-2y=$ x.	Apply	a
6	Solve $(x+1)^2\frac{d^2y}{dx^2}+(x+1)\frac{dy}{dx}=$ (2x+1)(2x+4).	Evaluate	a
7	Solve in series the equation 4x$\frac{d^2y}{dx^2}+2\frac{dy}{dx}+y=0$.	Evaluate	c
8	Solve in series $xy''+y'+xy=0$.	Evaluate	c
9	Solve in series $x(1-x)y''-3x\ y'-y=0$.	Apply	c
10	Solve in series $y''+x^2\ y=0$.	Evaluate	c
	(SHORT ANSWER TYPE QUESTIONS) **Unit – II**		
1	Prove that xJ_n'(x) = n J_n(x) - x J_{n+1}(x) .	Analyse	d
2	Prove that xJ_n'(x) = -n J_n(x) + x J_{n-1}(x).	Remember	d
3	Prove that J_n'(x) = $\frac{1}{2}[J_{n-1}$(x) $- J_{n+1}$(x)].	Understand	d
4	Express $J_2(x)$ *in terms of* $J_0(x)$ *and* $J_1(x)$.	Analyse	d
5	State Orthogonality of Legendre polynomials.	Analyse	d
6	Prove (2n+1) x$P_n(x)=(n+1)P_{n+1}(x)+nP_{n-1}(x)$.	Analyse	d
7	Prove that n$P_n(x)=x\,P_n'(x)-P_{n-1}'(x)$.	Understand	d
8	Prove that (2n+1) $P_n(x)$= $P_{n+1}'(x)-P_{n-1}'(x)$.	Analyse	d
9	Prove that (1-x^2) $P_n'(x)=n[p_{n-1}(x)-xP_n(x)]$.	Understand	d
10	Prove that $J_0^2+2(J_1^2+J_2^2+J_3^2+\cdots)=1$.	Analyse	d
	(LONG ANSWER QUESTIONS) **UNIT-II**		
1	Show that $\int_0^x x^nJ_{n-1}(x)dx=x^nJ_n(x)$.	Understand	d
2	Show that $\int_0^x x^{n+1}J_n(x)dx=x^{n+1}J_{n+1}(x)$.	Understand	d
3	Prove that $\frac{d}{dx}[J_n^2+J_{n+1}^2]=\frac{2}{x}[nJ_n^2-(n+1)J_{n+1}^2]$.	Apply	d
4	Prove that $\frac{d}{dx}[xJ_n(x)J_{n+1(x)}]=x[J_n^2(x)-J_{n+1}^2(x)]$.	Evaluate	d
5	Prove that $\frac{d}{dx}[x^nJ_n(ax)]=ax^nJ_{n-1}(ax)$.	Evaluate	d
6	Show that $J_n(x)=\frac{1}{\pi}\int_0^\pi cos(n\theta-xsin\theta)d\theta$.	Evaluate	d
7	Prove that (n+1) $P_n(x)$= $P_{n+1}'(x)-xP_n'(x)$.	Apply	d
8	Using Rodrigue's formula prove that $\int_{-1}^1 x^m\,p_n(x)dx=0$ if m<n.	Apply	d
9	Find the coefficient of t^n in the power series expansion of $e^{\frac{x}{2}\left(t-\frac{1}{t}\right)}$	Evaluate	d
10	Prove that $\int J_3(x)dx=-J_2(x)-\frac{2}{x}J_1(x)$.	Analyse	d
	(LONG ANSWER QUESTIONS) UNIT-III		
1	Find an analytic function whose imaginary part is v =$\frac{2sinxsiny}{cosh2x+cosh2y}$.	Apply	e
3	If f(z) is a regular function of z prove that $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)\|f(z)\|^2=4\left\|f'(z)\right\|^2$.	Apply	e
4	For w = e^{z^2} find u and v and prove that the curves u(x,y) = c_1 cuts orthogonally v(x,y) = c_2.	Apply	e

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5	Evaluate $\int_c \frac{z+4}{(z^2+2z+5)}$ dz where c is $\left\|z+1+i\right\|=2$ using Cauchy's integral formula.	Apply	e
6	Prove that if u $=x^2-y^2, v=\frac{-y}{x^2+y^2}$ both u and v satisfy Laplace's equation but u+iv is not a regular (analytic function) of z .	Analyse	e
7	Evaluate $\int_c \frac{z^3 e^{-z}}{(z-1)^3}$ dz where c is $\left\|z-1\right\|=\frac{1}{2}$ using Cauchy's integral formula.	Apply	e
8	Evaluate $\int_0^{2+i} z^2$ dz along (i) the real axis to 2 and then vertically to (2+i).	Evaluate	e
9	Evaluate $\int_c (y^2+2xy)dx+(x^2-2xy)dy$ where c is boundary of the region $y=x^2$ and $x=y^2$.	Evaluate	e
10	Verify Cauchy's theorem for the integral of z^3 taken over the boundary of the rectangle with vertices -1 ,1,1+i ,-1+i.	Apply	e
(SHORT ANSWER TYPE QUESTIONS) **UNIT-IV**			
1	Expand f(z) = $\frac{1}{z^2}$ in Taylor's series in powers of z +1 .	Analyse	k
2	Find Taylor's expansion for the function f(z) = $\frac{1}{(1+z)^2}$ with centre at -i.	Remember	k
3	Expand logz by Taylor's series about z=1.	Apply	k
4	Expand $f(z)=\frac{e^{2z}}{(z-1)^3}$ about z = 1 as Laurent's series also find the region of convergence.	Evaluate	k
5	Find zeros and poles of $\left(\frac{z+1}{z^2+1}\right)^2$.	Evaluate	i
6	Find the poles of the function $f(z)=\frac{1}{(z+1)(z+3)}$ and residues at these poles.	Evaluate	i
7	Find the residue of $\frac{ze^z}{(z-1)^3}$ at its poles.	Understand	i
8	Find the residue of $\frac{ze^{zt}}{(z-3)^2}$ at its poles.	Analyse	i
9	Find the poles and residues at each pole of f(z) = $\frac{z\sin z}{(z-\pi)^3}$.	Analyse	i
10	Find poles and residues of each pole of tanhz.	Evaluate	i

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	(LONG ANSWER QUESTIONS) **UNIT-IV**		
1	Evaluate $\oint_c \frac{1}{(z^2+4)^2}$ dz where c is the circle $\lvert z-i\rvert = 2$.	Apply	i
2	Evaluate $\oint_c \frac{z-3}{z^2+2z+5}$ dz where c is the circle given by (i) $\lvert z-1\rvert = 2$, (ii) $\lvert z+1-i\rvert = 2$, (iii) $\lvert z+1+i\rvert = 2$.	Evaluate	i
3	Evaluate $\int_c \frac{e^{2z}}{(z-1)(z-2)}dz$ where c is the circle $\lvert z\rvert = 3$.	Apply	i
4	Evaluate $\int_c \frac{e^{z}}{(z^2+\pi^2)^2}dz$ where c is the circle $\lvert z\rvert = 4$.	Apply	i
5	Evaluate $\int_c \frac{e^{2z}}{(z+1)^3}dz$ where c is the circle $\lvert z\rvert = 3$ using residue theorem.	Apply	i
6	Evaluate $\int_c \frac{ze^{z}}{(z^2+9)}dz$ where c is the circle $\lvert z\rvert = 5$ using residue theorem.	Apply	i
7	Show that $\int_0^{2\pi} \frac{d\theta}{4\cos^2\theta+\sin^2\theta} = \pi$.	Apply	i
8	Prove that $\int_0^{2\pi} \frac{d\theta}{1+a^2-2a\cos\theta} = \frac{2a\pi}{1-a^2}$.	Apply	i
9	Evaluate $\int_0^{2\pi} \frac{\sin 3\theta}{5-3\cos\theta}d\theta$.	Apply	i
10	Evaluate $\int_{-\infty}^{\infty} \frac{x^2-x+2}{x^4+10x^2+9}dx = \frac{5\pi}{12}$.	Evaluate	i
	(SHORT ANSWER TYPE QUESTIONS) **UNIT-V**		
1	Under the transformation $w = \frac{1}{z}$ find the image of the circle $\lvert z-2i\rvert = 2$	Understand	m
2	Find the bilinear transformation which maps the points z = 1 , i,-1 onto the points w = i,0,-i .	Understand	m
3	Find the bilinear transformation which transform the points ∞ ,i,0 in the z-plane into 0, i ,∞ in the w-plane.	Understand	m
4	Find the bilinear transformation which transform the points ∞ ,i,0 in the z-plane into -1,- i ,1 in the w-plane.	Understand	m

S.No	QUESTION	Blooms Taxonomy Level	Course Outcome
5	Determine the linear fractional transformation that maps $z_1 = 0, z_2 = 1, z_{3=}\infty$ $onto$ $w_1 = -1, w_2 = -i, w_3 = 1$.	Understand	m
6	Find the bilinear transformation which transform the points (-1,0,1) into the points (o,i,3i).	Understand	m
7	Find the bilinear transformation which transform the points (0,1, ∞)in the z-plane onto the points (-1,-2,-i) in the w-plane.	Analyse	m
9	Determine the bilinear transformation that maps the points (1-2i,2+i,2+3i) into the points (2+i,1+3i,4).	Evaluate	m
10	Find the fixed points of the transformation $w = \frac{2i-6z}{iz-3}$.	Understand	m
(LONG ANSWER QUESTIONS) UNIT-V			
1	Show that the transformation $w = \frac{1}{z}$ maps a circle to a circle or to a straight line if the former goes through the origin.	Understand	m
2	Find the image of $w = \frac{1+iz}{1-iz}$ if $\|z\| < 1$.	Evaluate	m
3	Find the image of (i) $\|w\| = 1$ $(ii)\|z\|$=1 in the w-plane Under the transformation $w = \frac{z-i}{1-iz}$.	Apply	m
4	Show that the function $w = \frac{1}{z}$ transforms the straight line x=c in the z-plane into a circle in the w-plane.	Analyse	m
5	Find the region in the w-plane in which the rectangle bounded by the lines x= 0 ,y = 0 x=2 and y=1 is mapped under the transformation w = z+(2+3i).	Evaluate	m
6	Show that the transformation $w = \frac{2z+3}{z-4}$ changes the circle $x^2 + y^2 - 4x = 0$ into the straight line 4u+3=0.	Analyse	m
7	Plot the image of the triangular region with vertices (0,0),(1,0)(0,1) under the transformation w = (1-i)z +3.	Analyse	m
8	Show that the transformation $w = \frac{2z+3}{z-4}$ transform the circle $\|z\|$=1 into a circle of radius unity in the w-plane.	Analyse	m
9	Show that the transformation $w = \frac{z-i}{z+i}$ maps the real axis in the z-plane into the unit circle $\|w\|$=1 in the w-plane.	Analyse	m
10	Find the image of the triangular region in the z-plane bounded by the lines x=0 y=0 and x+y = 1 under the transformation w = 2z.	Apply	m

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