Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2018

Programme Name: B.Tech. ECE+EE	**Semester : I**
Course Name : MATHEMATICS – I	**Time : 03 hours**
Course Code : MATH – 1009	**Max. Marks : 100**
Nos. of page(s) : 02	

SECTION A

S. No.		Marks	CO
Q1	Find the Eigen values of $5A, 3A^3, 2A^{-1}, \frac{A}{3}$ if $A=\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$.	4	CO1
Q2	Determine the Rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$.	4	CO1
Q3	Evaluate $\int_0^1 \int_0^x (x^2+y^2)\, dA$, where dA indicates small area in xy-plane.	4	CO3
Q4	Find the Fourier coefficient a_n for $f(x)=x\sin x, 0<x<2\pi$	4	CO4
Q5	Prove $a_n=\frac{1}{\pi}\int_0^{2\pi} f(x).\cos nx\, dx$.	4	CO4

SECTION B

Q6	Find the inverse of matrix $\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ using Cayley Hamilton Theorem, also convert the expression $A^8-5A^7+7A^6-3A^5+A^4-5A^3+8A^2-2A+I$ into quadratic equation.	8	CO1
Q7	Change the order of integration $\int_0^1 \int_{x^2}^{2-x} xy\,dy\,dx$ and hence evaluate.	8	CO3
Q8	Evaluate $\iint_R (x+y)^2\, dxdy$, where R is the parallelogram in xy plane with vertices	8	CO3

	$(1,0),(3,1),(2,2),(0,1)$ using the transformation $u=x+y$ and $v=x-2y$.		
Q9	Find the mass of tetrahedron bounded by coordinate axis and the plane $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$ the variable density is $\rho=xyz$.	8	CO3
Q10	If $y_1=\frac{x_2 x_3}{x_1}, y_2=\frac{x_3 x_1}{x_2} \wedge y_3=\frac{x_1 x_2}{x_3}$, find the Jacobean of x_1, x_2, x_3wrt y_1, y_2, y_3.	8	CO2
SECTION-C			
Q11 (A)	Prove that $\int_0^1 \frac{x^2 dx}{\sqrt{(1-x^4)}} . \int_0^1 \frac{dx}{\sqrt{(1+x^4)}}=\frac{\pi}{4\sqrt{2}}$	10	CO2
Q11 (B)	If $f(x)=\begin{cases} 0, & -\pi \le x \le 0 \\ \sin x, & 0<x\le \pi \end{cases}$, Hence deduce the series $\frac{1}{1.3}-\frac{1}{3.5}+\frac{1}{5.7}-\ldots=\frac{1}{4}(\pi-2)$.	10	CO4
Q12 (A)	Show that the surface $x^2-2yz+y^3=4$ is perpendicular to any number of the family of surfaces $x^2+1=(2-4a)y^2+az^2$ at the point of intersection $(1,-1,2)$	10	CO2
OR			
Q12 (A)	If $z=f(x,y)$ and $x=e^u \cos v$, $y=e^u \sin v$ prove that $x\frac{\partial z}{\partial v}+y\frac{\partial z}{\partial u}=e^{2u}\frac{\partial z}{\partial y}$ and find the value of $\left(\frac{\partial z}{\partial x}\right)^2+\left(\frac{\partial z}{\partial y}\right)^2$.	10.	CO2
Q12 (B)	Obtain a half range cosine series for $f(x)=\begin{cases} kx, & 0\le x\le l/2 \\ k(l-x), & l/2<x\le l \end{cases}$	10	CO4
OR			
Q12 (B)	Find the Fourier series expansion of $f(x)=2x-x^2, 0<x<3$ and hence find the value of $1-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\ldots=?$	10	CO4

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Name of the School (Please tick, symbol is given)	:	**SOE**	✓	**SOCS**		**SOP**	
Programme	:	**B. Tech. ECE+EE**					
Semester	:	**I**					
Name of the Course	:	**Mathematics-I**					
Course Code	:	**MATH-1009**					
Name of Question Paper Setter	:	**Pankaj Kumar Mishra**					
Employee Code	:	**40000516**					
Mobile & Extension	:	**9897618899**					
Note: Please mention additional Stationery to be provided, during examination such as Table/Graph Sheet etc. else mention "NOT APPLICABLE": NOT APPLICABLE							

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Name: **Enrolment No:**	UPES

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SECTION A

S. No.		Marks	CO
Q1	Determine the rank of matrix $\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$.	4	CO1
Q2	Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$	4	CO1
Q3	Evaluate $\int_0^5 \int_0^{x^2} x\left(x^2+y^2\right) dA$, where dA indicates small area in xy-plane.	4	CO3
Q4	Prove $b_n = \frac{1}{\pi} \int_0^{2\pi} f(x) . \sin nx \, dx$.	4	CO4
Q5	Find the Fourier coefficient b_n for $f(x) = \sqrt{1-\cos x}, 0<x<2\pi$	4	CO4

SECTION B

S. No.		Marks	CO
Q6	Find the inverse of matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$ using Cayley Hamilton Theorem, also convert the expression $A^5 - 20A^3 + 8A^2 + 2A + 5I$ into linear equation.	8	CO1
Q7	Evaluate $\iiint_R \left(x^2+y^2+z^2\right) dxdydz$ where R denotes the region bounded by $x=0, y=0, z=0$ and $x+y+z=a, a>0$.	8	CO3

Q8	Evaluate $\iint_D xy\sqrt{(1-x-y)}\,dxdy$ where D is the region bounded by $x=0$, $y=0$ and $x+y=1$ using the transformation $x+y=u$, $y=uv$.	8	CO3
Q9	Change the order of integration $\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{x}{\sqrt{(x^2+y^2)}}\,dydx$ and hence evaluate	8	CO3
Q10	If $u=x^2-y^2$, $v=2xy$ and $x=r.\cos\theta$, $y=r.\sin\theta$ find Jacobean of (r,θ) with respect to $(u,v$¿.	8	CO2
SECTION-C			
Q11 (A)	Prove that $\beta(m,1/2)=2^{2m-1}\beta(m,m)$.	10	CO2
Q11 (B)	Find the Fourier series of $f(t)=\begin{cases}-1, & -\pi<t\leftarrow\pi/2\\ 0, & -\pi/2<t<\pi/2\\ 1, & \pi/2<t<\pi\end{cases}$	10	CO4
Q12 (A)	Find the equation of the tangent plane and normal line to the following surface $x^2+2y^2+3z^2=12$ at $(1,2,-1)$.	10	CO2
OR			
Q12 (A)	If $u=Sin^{-1}\left(\frac{x+2y+3z}{\sqrt{x^8+y^8+z^8}}\right)$ than find the value of $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}$.	10	CO2
Q12 (B)	Obtain the Fourier cosine series for $f(x)=\begin{cases}kx, & 0\le x\le l/2\\ k(l-x), & l/2\le x\le l\end{cases}$, also deduce the sum of the series	10	CO4
OR			
Q12 (B)	Expand $f(x)=e^{-x}$ as a Fourier Series in the interval $(-l,l)$.	10	CO4