University of Mumbai
Online Examination 2020

Program: First Year Engineering
Curriculum Scheme: Rev 2012/2016/2019
Examination: First Year Semester I
Course Code: FEC-101 Course Name: Applied Mathematics-I

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Time: 1 hour **Max. Marks: 50**

Q1.	Simplify $\frac{(\cos 3\theta + i\sin 3\theta)(\cos\theta - i\sin\theta)}{(\cos 5\theta + i\sin 5\theta)}$
Option A:	$(\cos 7\theta + i\sin 7\theta)$
Option B:	$(\cos 3\theta + i\sin 3\theta)$
Option C:	$(\cos 5\theta + i\sin 5\theta)$
Option D:	$(\cos\theta + i\sin\theta)$
Q2.	If $\tanh x = 1/2$, then find the value of x and $\sinh 2x$
Option A:	$x = 1/2\log(3), \sinh 2x = 4/5$
Option B:	$x = -1/2\log(3), \sinh 2x = 4/5$
Option C:	$x = 1/2\log(3), \sinh 2x = 4/3$
Option D:	$x = -1/2\log(3), \sinh 2x = 4/3$
Q3.	If $\tan[\log(x+iy)] = a+ib$, then select the correct equality from the options given below:
Option A:	$\tan[\log(x^2+y^2)] = \frac{2a}{1-a^2-b^2}, a^2-b^2=1$
Option B:	$\tan[\log(x^2+y^2)] = \frac{2a}{1-a^2-b^2}, a^2+b^2=1$
Option C:	$\tan[\log(x^2+y^2)] = \frac{2a}{1-a^2+b^2}, a^2-b^2=1$
Option D:	$\tan[\log(x^2+y^2)] = \frac{2a}{1-a^2+b^2}, a^2+b^2=1$
Q4.	Simplify the value of $Z = e^{2a/\cot^{-1}b} \cdot \left[\frac{bi-1}{bi+1}\right]^{-a}$, where $a,b \in \Re$

Option A:	$Z=0$
Option B:	$Z=i$
Option C:	$Z=-i$
Option D:	$Z=1$
Q5.	If $u(x,y)=\tan^{-1}\left(\frac{y}{x}\right)$, find the value of $I=\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial x^2}$
Option A:	$I=0$
Option B:	$I=x$
Option C:	$I=x+y^2$
Option D:	$I=1$
Q6.	If $u(x,y)=\left(\frac{x^3y^3}{x^3+y^3}\right)+\log\left(\frac{x^3}{x^3+y^3}\right)$, then find the value of $I=x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$
Option A:	$I=3\log\left(\frac{x^3}{x^3+y^3}\right)$
Option B:	$I=\log\left(\frac{x^3}{x^3+y^3}\right)$
Option C:	$I=\left(\frac{x^3y^3}{x^3+y^3}\right)$
Option D:	$I=3\left(\frac{x^3y^3}{x^3+y^3}\right)$
Q7.	If $u(x,y)=\tan^{-1}\left(\frac{x^2+y^2}{x-y}\right)$, then find the value of $I=x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$.
Option A:	$I=\frac{1}{4}\sin u$
Option B:	$I=\frac{1}{4}\cos u$
Option C:	$I=\frac{1}{2}\sin 2u$
Option D:	$I=\frac{1}{4}\sin 2u$
Q8.	Find the minimum value of $f=xy+a^3\left(\frac{1}{x}+\frac{1}{y}\right)$.
Option A:	a^2
Option B:	$3a^2$
Option C:	$2a^2$

Option D:	$5a^2$
Q9.	Find the maxima of $f = x^2 + y^2$, subjected to the condition $x + y = 2$.
Option A:	2
Option B:	4
Option C:	5
Option D:	8
Q10.	Find the nth derivative of $y = \frac{x^3}{(x+1)(x-2)}$ with respect to the variable x.
Option A:	$y_n = \frac{(-1)^n \cdot n!}{3}\left[\frac{1}{(x+1)^{n+1}} - \frac{8}{(x-2)^{n+1}}\right]$
Option B:	$y_n = \frac{(-1)^n \cdot n!}{3}\left[\frac{1}{(x+1)^{n+1}} - \frac{4}{(x-2)^{n+1}}\right]$
Option C:	$y_n = \frac{(-1)^n \cdot n!}{3}\left[\frac{1}{(x+1)^{n+1}} + \frac{8}{(x-2)^{n+1}}\right]$
Option D:	$y_n = \frac{(-1)^n \cdot n!}{3}\left[\frac{1}{(x+1)^{n+1}} + \frac{4}{(x-2)^{n+1}}\right]$
Q11.	Select the correct form of the Leibnitz theorem from the options given below:
Option A:	$y_n = {}^nC_0 u_n v + {}^nC_1 u_{n-1} v_1 + {}^nC_2 u_{n-2} v_2 + \ldots + {}^nC_n u v_n$ where $y = u + v$
Option B:	$y_n = {}^nC_0 u_n v + {}^nC_1 u_{n-1} v_1 + {}^nC_2 u_{n-2} v_2 + \ldots + {}^nC_n u v_n$ where $y = u - v$
Option C:	$y_n = {}^nC_0 u_n v + {}^nC_1 u_{n-1} v_1 + {}^nC_2 u_{n-2} v_2 + \ldots + {}^nC_n u v_n$ where $y = u / v$
Option D:	$y_n = {}^nC_0 u_n v + {}^nC_1 u_{n-1} v_1 + {}^nC_2 u_{n-2} v_2 + \ldots + {}^nC_n u v_n$ where $y = uv$
Q12.	Select the correct answer from the options given below:
Option A:	Every square matrix cannot be uniquely expressible in form of the sum of a symmetric and skew symmetric matrix.
Option B:	Every square matrix cannot be uniquely expressible in form of the sum of a Hermition and skew Hermition matrix.
Option C:	Every skew Hermition matrix can be expressible in form of the sum of a real symmetric and real skew symmetric matrix.
Option D:	Every skew Hermition matrix can be expressible in form of the sum of a real skew symmetric and real symmetric matrix.
Q13.	If $A = \begin{bmatrix} 1/\sqrt{3} & 1/\sqrt{2} & 1/\sqrt{2} \\ 1/\sqrt{3} & -2/\sqrt{6} & 0 \\ 1/\sqrt{3} & 1/\sqrt{6} & -1/\sqrt{2} \end{bmatrix}$, then find the inverse of A.

Option A:	$A=\begin{bmatrix}1/\sqrt{3} & -1/\sqrt{2} & 1/\sqrt{2}\\ 1/\sqrt{3} & -2/\sqrt{6} & 3\\ 1/\sqrt{3} & 1/\sqrt{6} & -1/\sqrt{2}\end{bmatrix}$
Option B:	$A=\begin{bmatrix}1/\sqrt{3} & -1/\sqrt{2} & 1/\sqrt{2}\\ 1/\sqrt{3} & -2/\sqrt{6} & 0\\ 1/\sqrt{3} & 1/\sqrt{6} & -1/\sqrt{2}\end{bmatrix}$
Option C:	$A=\begin{bmatrix}1/\sqrt{3} & 1/\sqrt{3} & 1/\sqrt{3}\\ 1/\sqrt{2} & -2/\sqrt{6} & 1/\sqrt{6}\\ 1/\sqrt{2} & 0 & -1/\sqrt{2}\end{bmatrix}$
Option D:	$A=\begin{bmatrix}1/\sqrt{3} & 1/\sqrt{3} & -1/\sqrt{3}\\ 1/\sqrt{2} & -2/\sqrt{6} & -1/\sqrt{6}\\ 1/\sqrt{2} & 0 & -1/\sqrt{2}\end{bmatrix}$
Q14.	Find the rank of matrix $A=\begin{bmatrix}1 & 1 & 1\\ 1 & -1 & -1\\ 3 & 1 & 1\end{bmatrix}$.
Option A:	Rank (A)=1
Option B:	Rank (A)=2
Option C:	Rank (A)=3
Option D:	Rank (A)=0
Q15.	Find the solution of following system of equations given by 2x-3y+7z=5, 3x+y-3z=13, 2x+19y-47z=32.
Option A:	No Solution Exist
Option B:	x=2, y=4, z=5
Option C:	x=2, y=-4, z=5
Option D:	x=-2, y=4, z=-5
Q16.	The system of equations 2x-2y+z=tx, 2x-3y+2z=ty, -x+2y=tz, will posses a solution for which values of constant t.
Option A:	t=1,3
Option B:	t=-1,3
Option C:	t=1,-3
Option D:	t=-1,-3
Q17.	Select the correct root of the equation $2x-3\sin x-5=0$, up to the four decimal places from the options given below:
Option A:	2.3456
Option B:	2.5674
Option C:	2.4334
Option D:	2.8830
Q18.	Select the correct root of the equation $x^3-2x-5=0$, up to the four decimal places from the options given below:
Option A:	2.9456
Option B:	2.8674

Option C:	2.0946
Option D:	2.0901
Q19.	Select the correct Gauss Seidel approximation scheme to solve the system of equation given by 12x-9y+7z=12, x-13y+5z=34, 2x-6y+19z=9.
Option A:	$x^{(n+1)}=\frac{1}{12}\left[12+9y^{(n)}-7z^{(n)}\right]$ $y^{(n+1)}=\frac{-1}{13}\left[34-x^{(n)}+5z^{(n)}\right]$ $z^{(n+1)}=\frac{1}{19}\left[9-2x^{(n)}+6y^{(n)}\right]$
Option B:	$x^{(n+1)}=\frac{1}{12}\left[12+9y^{(n)}-7z^{(n+1)}\right]$ $y^{(n+1)}=\frac{-1}{13}\left[34-x^{(n+1)}+5z^{(n)}\right]$ $z^{(n+1)}=\frac{1}{19}\left[9-2x^{(n)}+6y^{(n+1)}\right]$
Option C:	$x^{(n+1)}=\frac{1}{12}\left[12+9y^{(n)}-7z^{(n)}\right]$ $y^{(n+1)}=\frac{-1}{13}\left[34-x^{(n+1)}+5z^{(n)}\right]$ $z^{(n+1)}=\frac{1}{19}\left[9-2x^{(n+1)}+6y^{(n+1)}\right]$
Option D:	$x^{(n+1)}=\frac{1}{12}\left[12+9y^{(n)}-7z^{(n)}\right]$ $y^{(n+1)}=\frac{-1}{13}\left[34-x^{(n-1)}+5z^{(n-1)}\right]$ $z^{(n+1)}=\frac{1}{19}\left[9-2x^{(n)}+6y^{(n)}\right]$
Q20.	Select the correct equality from the options given below:
Option A:	$\cos x=1+x+x^2+x^3+\ldots$
Option B:	$\tan^{-1}x=1+x+x^2+x^3+\ldots$
Option C:	$\frac{1}{1+x}=1+x+x^2+x^3+\ldots$
Option D:	$\frac{1}{1-x}=1+x+x^2+x^3+\ldots$
Q21.	Select the correct equality from the options given below:
Option A:	$\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)=\frac{1}{2}\left[x-\frac{x^3}{3}+\frac{x^5}{5}-\ldots\right]$

Option B:	$\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x^2}\right)=\frac{1}{2}\left[x-\frac{x^3}{3}+\frac{x^5}{5}-...\right]$
Option C:	$\tan^{-1}\left(\frac{\sqrt{1+x^2}+1}{x^2}\right)=\frac{1}{2}\left[x+\frac{x^3}{3}+\frac{x^5}{5}+...\right]$
Option D:	$\tan^{-1}\left(\frac{\sqrt{1+x^2}+1}{x^2}\right)=\frac{1}{2}\left[x-\frac{x^3}{3}+\frac{x^5}{5}-...\right]$
	This section is strictly for 2012/2016 R
Q22.	Find the value of the limit given by $\underset{x\to 0}{lt}\ \frac{3^x-2^x}{x}$.
Option A:	Log (3/2)
Option B:	Log (3/4)
Option C:	3/2
Option D:	¾
Q23.	Find the value of the limit given by $\underset{x\to 0}{lt}\left[\frac{a}{x}-\cot\frac{x}{a}\right]$.
Option A:	2
Option B:	A
Option C:	0
Option D:	-1
	This section is strictly for 2012R ONLY
Q24.	Find the line of best fit to the data given by X: 1 2 3 4 5 Y: 3 18 23 34 45
Option A:	Y=-5+9X
Option B:	Y=5+6X
Option C:	Y=-5+10X
Option D:	Y=10-5X
Q25.	Find the line of best fit to the data given by X: 3 5 7 9 11 Y: -1 4 13 24 45
Option A:	$Y=3+3X+X^2$
Option B:	$Y=3-3X+X^2$
Option C:	$Y=-3+3X+X^2$
Option D:	$Y=3+3X-X^2$