# ***Question Bank- Fourier Series***

1. Explain periodic function with examples.
2. State Dirichlet's conditions for a function to be expanded as a Fourier series.
3. State whether *y* =tan *x* can be expressed as a Fourier series. If not why?
4. State the convergence condition on Fourier series.
5. If f(x)= sinhx is defined in interval (-π, π). Find $a_0$ and $a_n$?
6. Find half range cosine expansion of the function $f(x)=(x-1)^2$ in the interval [0,1]
7. Find the period of f(x) = cos3x and g(x) = a, where a is a constant.
8. A periodic function of period 4 is defined as f(x)=|x| in interval (-2,2), Find Euler's coefficient for this f(x).
9. Can f(x)= tanx be expanded as a Fourier series in the interval (-π, π)?
10. What is the Fourier Series of the function $\sin^3 x$ in $(0,2\pi)$?
11. Find the Fourier series in the interval $f(x)=\begin{Bmatrix} 0, & -2 < x < -1 \\ k, & -1 < x < 1 \\ 0, & 1 < x < 2 \end{Bmatrix}$
12. Find the series of cosines of multiples of x which will represent x sin x in the interval (0, π).
13. Show that in the interval (0,1), $\cos \pi x = \frac{8}{\pi}\sum_{n=1}^{\infty} \frac{n}{4n^2-1} \sin 2n\pi x$ .
14. Find the Fourier series for f(x) =|cos x| in (-π, π).
15. Write the Fourier series for Saw-Toothed Waveform. Also draw its curve.
16. Write the Fourier series for Triangular Waveform. Also draw its curve.
17. Express 2 as Fourier Series in (0, π).
18. Define Euler's formula for the function $\emptyset(x)$ in the interval over the interval of length 2k.
19. State Sufficient condition for the Fourier Series to be convergent?
20. Evaluate $b_n$ for $f(x)= x^2-x^4$.

# ***Question Bank- Partial Differentiation***

1. For the function f(x,y)= $\begin{cases} 0 & , (x,y)\neq(0,0) \\ \dfrac{xy(2x^2-3y^2)}{x^2+y^2} & ,(x,y)=(0,0) \end{cases}$

   Find $f_{xy}(0,0)$ and $f_{yx}(0,0)$ and prove that $f_{xy}$ and $f_{yx}$ are discontinuous at (0,0).
2. If $u = x^2y+y^2z+z^2x$ , Prove that $u_x+u_y+u_z=(x+y+z)^2$.
3. If u = log (tan x + tan y), Prove that $sin2x\,\frac{\partial u}{\partial x}+sin2y\,\frac{\partial u}{\partial y}=2.$
4. If u = log $\sqrt{x^2+y^2+z^2}$,Prove $(x^2+y^2+z^2)\left(\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}\right)=1.$
5. If u = $\frac{x^2y^2}{x+y}$ ,Show that $x\frac{\partial^2 u}{\partial x\partial y}+y\frac{\partial^2 u}{\partial y^2}=2\frac{\partial u}{\partial y}.$
6. If u = f(r,s,t) , r=$\frac{x}{y}$ ,s=$\frac{y}{z}$ ,t=$\frac{z}{x}$. Prove That $xu_x+yu_y+zu_z=0$.
7. If $x^3+y^3-3axy = 0$ ,Find $\frac{dy}{dx}\,and\,\frac{d^2y}{dx^2}$ using partial differentiation.
8. If u=$\frac{yz}{x}$, v=$\frac{zx}{y}$, w=$\frac{yx}{z}$, Show that $\frac{\partial(u,v,w)}{\partial(x,y,z)}=4.$
9. Find equation of tangent plane and normal line to $\emptyset = z^2= 4(1+x^2+y^2)$ at (2,2,6)
10. Show that the plane 3x+12y-6z-17=0 touches the conicoid $3x^2-6y^2+9z^2+17=0$. Find the point of contact.
11. Expand f(x,y)=sinxy, upto second degree terms in powers of (x-1) and (y- $\pi/2$)
12. Expand $f(x,y)=21+x-20y-4x^2+xy+6y^2$ in Taylor's series of maximum order about the point (-1,2).
13. Show that the Maclaurin's Series for $e^y\log(1+x)=x+xy-x^2/2$ approximately.
14. The period T of a simple pendulum of length l is given by $T=2T_1\sqrt{\frac{l}{g}}.$

    Find (i) the error (ii) percentage error made in computing T by using l=2ft and g = 32ft/sec$^2$ if the true values are l=1.95 and g=32.3ft/sec$^2$.
15. Find the percentage error in area of rectangle when an error of 1% is committed in measuring its length and error of -2% in its breadth.
16. The radius of the circle is found to be 100cm. Find the relative error in the area of the circle due to an error of 1mm in its radius.

17. Find the possible percentage error in computing the resistance r from the formula $\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2}$ , when both $r_1$ and $r_2$ are in error by 2% .
18. Locate the stationary points of $x^4+y^4-2x^2+4xy-2y^2$ and determine their nature.
19. Examine the minima and maxima of sin x + sin y + sin (x+y).
20. The rectangular box open at the top is to have volume of 32 cubic feet. Find the dimensions of the box requiring least material for its construction.
21. Show that the rectangular solid of maximum volume that can be inscribed in a given sphere is a cube.The sum of three positive numbers is constant . Prove that their product is maximum when they are equal.
22. What are the advantages and disadvantages of Lagranges method of undetermined multiplier?
23. Find the minimum value of $x^2+y^2+z^2$ given that $xyz=a^3$.
24. Use Lagrange's method to find the minimum value of $x^2+y^2+z^2$ subject to the condition x+y+z=1 and xyz+1=0.
25. Find the shortest and the longest distance from the point (3,4,12) to the sphere $x^2+y^2+z^2=1$.
26. Find the shortest and the longest distance from origin to the curve $5x^2+6xy+5y^2-8=0$.
27. If u=$a^3x^2 + b^3y^2 + c^3z^2$ where $x^{-1}+y^{-1}+z^{-1}=1$, show that the stationary value of u is given by $x = \frac{\sum a}{a} + \frac{\sum a}{b} + \frac{\sum a}{c}$
28. What is the necessary condition for a function f(x,y) to have an extremum at (a,b).
29. Define saddle point of a function of two variable while giving an example.
30. State the method to find maxima and minima by using partial differentiations.