DEPARTMENT OF APPLIED SCIENCES (MATHEMATICS)

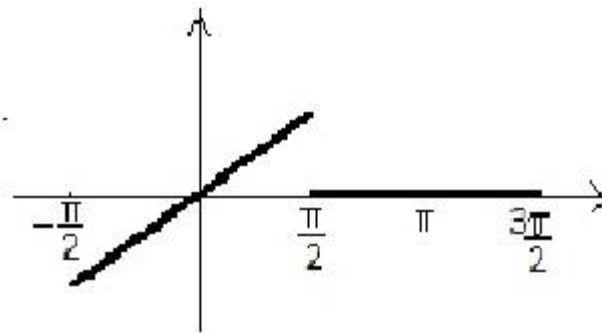| |
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| **Assignment No. 1** |
| **Title of Course: Differential Equations and Transformations** |
| **Course Code: 22AS002** |
| **Topic Name: Fourier Series and Transform** |

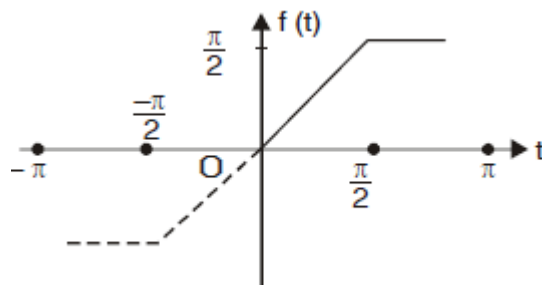1. Determine the trigonometric form of Fourier series of the below waveform.
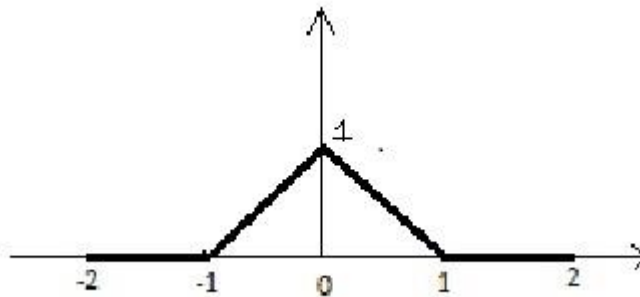
2. Find the Fourier series expansion of the following signal in the period [-1, 1].
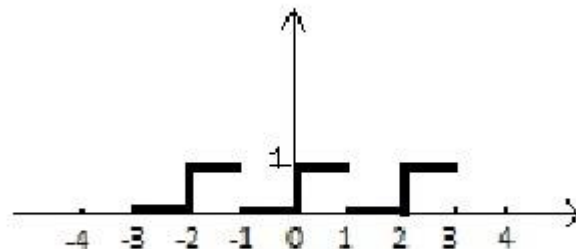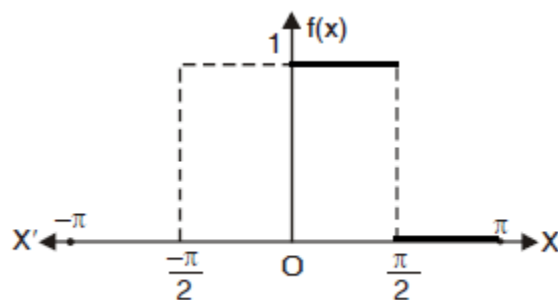

3. Find the Fourier series of the wave shown in following fig.

4. Represent the following function by a Fourier sine series:

5. An alternating current after passing through a rectifier has the exponential form $i = e^{\theta}$, $0 < \theta < \pi$. Find the Fourier cosine and sine series of the function.

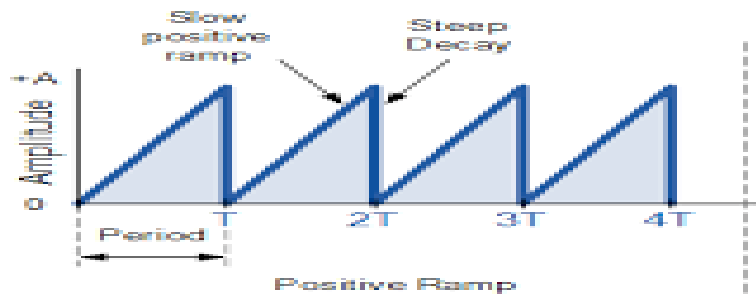6. Determine the Fourier cosine series for the function

7. Obtain the Fourier cosine series expansion of the periodic function

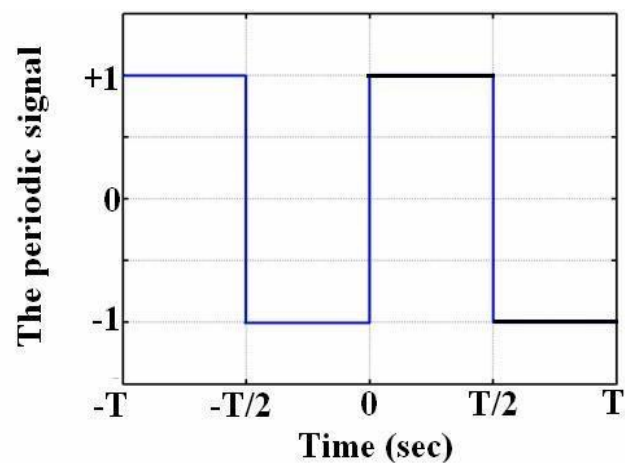$$f(t) = \sin\left(\frac{\pi t}{10}\right), \quad 0 < t < 10.$$

8. Find the fourier series for the periodic expansion of the following signal in the period $[0, 2\pi]$
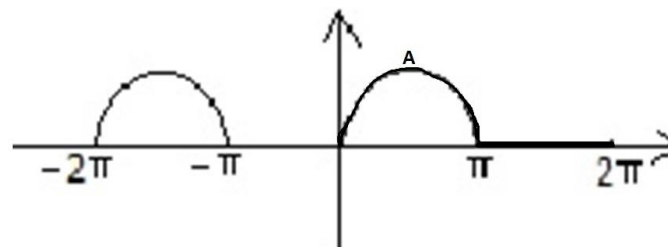
9. Determine the trigonometric form of Fourier series of the ramp signal

10. Find the fourier series of the square wave shown in following fig.

11. Find the Fourier transform of the function given by

$$f(t) = \begin{cases} 1 \text{ for } & -a \le t < a \\ 0 \text{ for } & t < -a \text{ and for } t \ge a \end{cases}$$
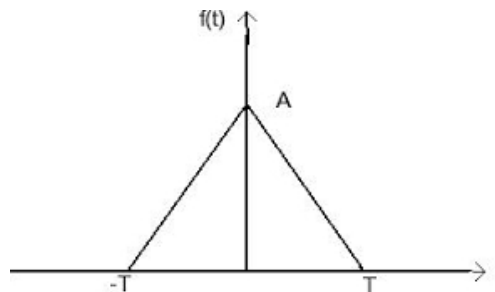
Use Parseval's identity to show $\displaystyle\int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2}$

12. Find the Fourier transform for

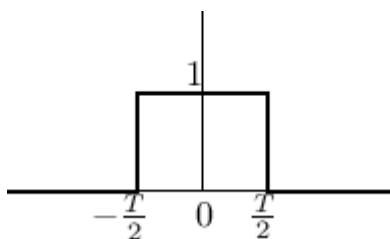(i) unit step function

(ii) the signal $x(t) = e^{-3|t|} u(t)$

13. Find the Fourier transform of the following triangular pulse for A=1.

14. Find the Fourier transform of the following rectangular pulse

15. Find the Fourier transform for the signal $x(t) = e^{-at} u(t)$.

16. A continuous time signal varies exponentially in the interval 0 to T. Find the Fourier constant $a_0/2$ of the signal.

17. Find the Fourier constant a_n for continuous time signal defined as

$$f(t) = \begin{cases} Kt & for \quad 0 \le t \le T/2 \\ K(T-t) & for \quad T/2 \le t \le T \end{cases}$$

18. Find the Fourier Sine transform of $f(t) = \dfrac{e^{-ax}}{x}, a > 0$. Using Shifting property find

$F_s(f(4t))$.

19. Find the Fourier series of $f(x) = x + x^2$ where $x \in [-\pi, \pi]$

20. Find the Fourier series of triangular wave form in $[-\pi, \pi]$

21. Find the Fourier Transform of e^{-x^2}. Hence find the Fourier Transform of $f(x) = e^{-ax^2}$, a>0.

22. Find the Fourier Transform of $f(x) = xe^{-a|x|}$, a>0.

23. Find Fourier Transform of xe^{ax}, x > 0 .Using Fourier Transform of Derivatives, find the fourier

transform of $axe^{ax} + e^{ax}$.

24. Find Fourier transform of the function $f(t) = e^{-a|t|}, -\infty < t < \infty, a > 0$. Write the inverse Transform.

25. If $F\left(e^{-3t}u(t)\right) = \dfrac{1}{\sqrt{2\pi}}\left(\dfrac{1}{3+is}\right)$ then find the inverse Fourier transform.of

$$F(s) = \dfrac{e^{4is}}{3+is}.$$