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324351 (14)

BE (3^{rd} Semester)

Examination, Nov.-Dec., 2013

Branch : Electrical Engineering

MATHEMATICS - III (NEW)

Time Allowed : Three Hours

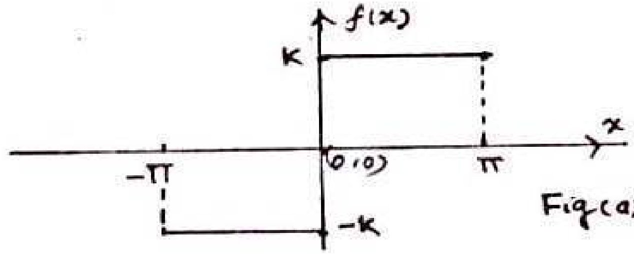
Maximum Marks : 80

Minimum Pass Marks : 28

Note : Part (a) is compulsory. Attempt any two parts from (b), (c) and (d).

Q. 1. (a) State Dirichelet's condition for Fourier expansion.

(b) Find the Fourier coefficients of periodic function f(x) in the following fig. (a) and prove that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots$



Fig(a)

(c) State wheather the given function in even or odd. Find its Fourier series. Sketch the function.

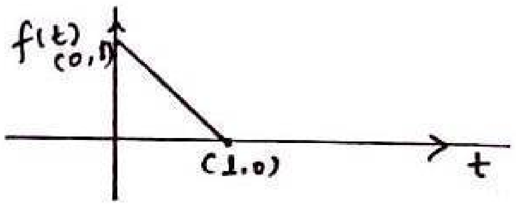
$$f(x) = \begin{cases} -2x & \text{when } -\pi < x < 0 \\ 2x & \text{when } 0 < x < \pi \end{cases}$$

(d) The following table gives the variations of periodic currents over a period :

x :	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
y :	1.98	1.30	1.05	1.30	−0.88	−0.25	1.98

Show that there is a direct current part of 0.75 amp in the variable current and obtained the amplitude of the first harmonic.

Q. 2. (a) Find the Laplace transform of the following function.



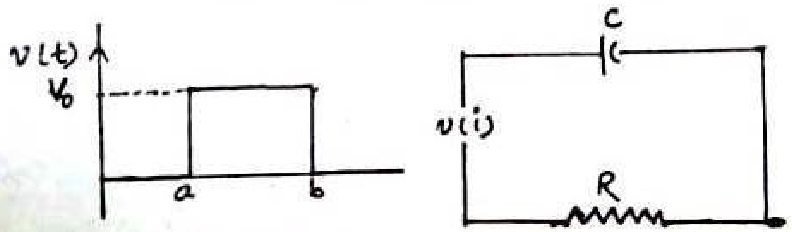
(b) (i) Find the inverse Laplace transform of the following function :

$$\log\left[\frac{s+1}{s-1}\right]$$

(ii) Find the Laplace transform of the following function

$$f(t) = \frac{1-\cos 2t}{t}$$

(c) Find the current i(t) in the circuit in Fig. (b) if a single square wave with voltage V_0 is applied. The circuit is assumed to be quiescent before square wave is applied.



(d) Solve by using Laplace transform method :

$$y(t) = t + \int_0^t y(\tau)\sin(t-\tau)\,d\tau.$$

Q. 3. (a) Drive a partial differential equation by eliminating the constant from equation :

$$2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$$

(b) Solve :

$$(x^2 - y^2 - z^2)p + 2xyq = 2xz.$$

(c) Solve the following partial diferential equation

$$(D^2 - DD' - 2D'^2)z = (y-1)e^x.$$

(d) Using the method of separation of variables, solve :

$$\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u,$$

where $u(x, 0) = 6e^{-3x}$.

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Q. 4. (a) State Cauchy Riemann equation for analytic function.

(b) Show that the function $f(z) = \sqrt{|xy|}$ is not analytic at the origin even through C.R equations are satisfied thereat.

(c) Prove that :

$$\int_0^{2\pi} \frac{\cos 2\theta\, d\theta}{1 - 2p\cos\theta + p^2} = \frac{2\pi p^2}{1-p^2},\ \text{where } -1 < p < 1.$$

(d) Expand :

$$f(z) = \frac{z^2 - 6z - 1}{(z-3)(z-1)(z+2)},$$

in the region $3 < |z + 2| < 5$.

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Q. 5. (a) Show that $Z(\delta_{n+1}) = \frac{1}{z}$.

(b) State Convolution Theorem for Z transform and using it find inverse Z transform of the following function,

$$\left[\frac{z^2}{(z-a)(z-b)}\right]$$

(c) Solve :

$$y_{n+2} + 6y_{n+1} + 9y_n = 2^n$$

with $y_0 = y_1 = 0$, using Z-transforms.

(d) Using the power series method find the inverse transform of the following function

$$\frac{1}{(z-2)(z-3)}$$

for (i) $|z| < 2$, (ii) $2 < |z| < 3$, (iii) $|z| > 3$.

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