



KERALA AGRICULTURAL UNIVERSITY  
B. Tech. (Agrl. Engg.) 2023 Admission  
II Semester Final Examination – July 2024

Sacs.1206

Engineering Mathematics II (2+1)

Marks: 50  
Time: 2 hours

I Choose the correct answer

(10x1=10)

- The integral of  $\oint_C \frac{dz}{z^2+9}$ , where  $C$  is the unit circle is
  - 0
  - 1
  - 3
  - 3
- The singularity of the function  $\frac{e^z-1}{z}$  is
  - $\pi$
  - $-\pi$
  - 1
  - 0
- The Fourier series expansion of  $x^3$  in the interval  $-1 \leq x \leq 1$  with periodic continuation has
  - Only sine term
  - Only cosine term
  - Both sine and cosine term
  - Only sine term and a non-zero constant
- Which of the following is true for the Fourier coefficients of an odd function?
  - $a_0 = 0, a_n = 0$  and  $b_n \neq 0$
  - $a_0 \neq 0, a_n \neq 0$  and  $b_n = 0$
  - $a_0 \neq 0, a_n = 0$  and  $b_n \neq 0$
  - $a_0 = 0, a_n \neq 0$  and  $b_n \neq 0$
- The partial differential equation  $pq = 4z$  is
  - linear
  - non-linear
  - higher order
  - none of these
- Which of the following is a Lagrange's partial differential equation?
  - $pq = 4z$
  - $p^2 + q = 1$
  - $px^2 + qy^2 = z^2$
  - none of these

Answer the following

- Write auxiliary equation for  $xp + yq = 3z$
- Explain comparison test
- Define Cauchy-Riemann equation
- Find the sum of the series  $1 + \frac{2}{3} + \left(\frac{2}{3}\right)^2 + \dots + \left(\frac{2}{3}\right)^{n-1}$

**II Write short notes on ANY FIVE of the following (5x2=10)**

1. Find all possible values of  $x$  for which the series  $\sum_{n=0}^{\infty} \frac{9+x^n}{5^n}$  converges.
2. Find the Fourier coefficient  $a_n$  for the function  $f(x) = x^2$ ,  $-\pi \leq x \leq \pi$
3. Obtain the cosine series for  $f(x) = x$  in the interval  $0 \leq x \leq \pi$
4. Derive a partial differential equation from the relation  $z = f(x^2 + y^2)$
5. Solve  $p\sqrt{x} + q\sqrt{y} = \sqrt{z}$
6. Find the real and imaginary part of the function  $f(z) = z^2 + 3z$
7. Verify Cauchy Riemann equation for  $f(z) = e^{-z}$

**III Answer ANY FIVE of the following (5x4=20)**

1. Test the convergence of the series  $\frac{2}{1^2+1} + \frac{2^2}{2^2+1} + \frac{2^3}{3^2+1} + \dots$
2. Find the Fourier series of the periodic function  $f(x)$  with period  $2\pi$ , defined as follows:  
$$f(x) = \begin{cases} 0, & \text{if } -\pi \leq x \leq 0 \\ x, & \text{if } 0 \leq x \leq \pi \end{cases}$$
3. Find the Fourier transform of  $f(x) = \begin{cases} 1, & \text{if } a < x < b \\ 0, & \text{otherwise} \end{cases}$
4. Using the method of separation of variables, solve  $u_{xy} - u = 0$
5. Solve  $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$
6. Find the Taylor series of  $\frac{1}{1+z}$  about the centre  $z_0 = i$
7. Use Cauchy's integral formula to evaluate  $\oint_c \frac{z^2+1}{z^2-1} dz$  counter clockwise around  $|z+1| = 1$ .

**IV Write an essay on ANY ONE of the following (1x10=10)**

1. Find the temperature  $u(x, t)$  in a homogenous bar heat conducting material of length  $l$  whose ends kept at  $0^\circ\text{C}$  and whose initial temperature is given by  $u(x, 0) = lx - x^2$
2. Evaluate  $\int_0^{2\pi} \frac{\sin^2 \theta d\theta}{5-4\cos \theta}$

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