



KERALA AGRICULTURAL UNIVERSITY
B.Tech.(Food Engg.) 2016 Admission
III Semester Final Examination-Janauary-2018
Engineering Mathematics-III (2+1)

Basc.2108

Marks: 50
 Time: 2 hours
 (10x1=10)

I Fill in the blanks:

1 Gradient of a scalar function is a scalar and the divergence of a constant is _____

Choose the Correct answer

2 $\text{div}(\text{grad}\phi) =$ _____

- a 0 b $\nabla \cdot \text{div}(\phi)$ c $\text{grad}\phi$ d $\nabla^2 \phi$

3 If $\phi = 2x^3y^2z^4$ then $(\nabla^2\phi)_{(1,1,1)} =$ _____

- a 24 b 12 c 40 d 36

4 If $f(x)$ is an odd function defined in $(-L,L)$, what is the value of a_0

- a 1 b 2 c 0 d 5

5 A certain function $u(x,y)$ can be the real part of an analytic function if

- a u satisfies C-R equation c u is harmonic
 b u is a continuous function d None of these

6 The value of the integral $\int_C \frac{dz}{z^2} = 0$ where C is,

- a $|z|=1$ b $|z-1|=2$ c $|z|=2$ d $|z-2|=1$

State True or False

7 The vector function is the gradient of a scalar function, then the function is conservative

8 If $f(x)=1, 0 < x < \infty$ can be represent as a Fourier integral.

9 If $f(z)$ is analytic function, then $kf(z)$ is also analytic function where k is a constant.

Define the following

10 Write Parseval's identity for Fourier Sine Transform

II Write Short notes on ANY FIVE of the following

(5x2=10)

1 Show that the function $x^4 - 6x^2y^2 + y^4$ is harmonic.

2 Verify whether $w=\sin(x)\cosh(y)+i\cos(x)\sinh(y)$ is analytic or not.

3 The Laurent's series expansion of $\frac{1}{z(z-1)}$ valid in $|z|>1$ is

4 Find the Fourier cosine transform of e^{-x} .

5 Find the constant term in the Fourier series corresponding to $f(x)=\cos^2(x)$ expressed in the interval $(-\pi, \pi)$.

6 If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$, then find $\nabla\left(\frac{1}{r}\right)$?

7 If $\vec{F} = (x-3y)\vec{i} + (y-2x)\vec{j}$ and C is the line segment from $(0,0)$ to $(3,1)$ then find $\int_C \vec{F}d\vec{r}$.

III Answer ANY FIVE of the following

(5x4=20)

- 1 Find the directional derivative of $\phi = xy + yz + zx$ in the direction of the vector $\hat{i} + 2\hat{j} + 2\hat{k}$ at $(1, 2, 0)$.
- 2 Evaluate $\int (x dy - y dx)$ around the circle $x^2 + y^2 = 1$.
- 3 Evaluate $\int_C \{(xy + x^2) dx + (x^2 + y^2) dy\}$, where C is the square formed by the lines $x = -1$ to 1 and $y = -1$ to 1 using Green's theorem.
- 4 If for $0 < x < L$, the function $f(x)$ has the expansion $f(x) = \sum_{n=1}^{\infty} b_n \sin\left(\frac{n\pi x}{L}\right)$ then find $\int_0^L [f(x)]^2 dx$.
- 5 Find the Fourier Transform of $f(x) = \begin{cases} 1; & |x| < a \\ 0; & |x| > a \end{cases}$.
- 6 Find the Fourier transform of $e^{-|x|}$, then find $\int_0^{\infty} \frac{dx}{(x^2 + 1)^2}$.
- 7 Find the image of the circle $|z|=2$ by the transformation $w = z + 3 + 2i$

IV Write an essay on ANY ONE of the following

(1x10=10)

- 1 Evaluate $\int_0^{\infty} \frac{dx}{(x^2 + a^2)(x^2 + b^2)}$ using Fourier Transform.
- 2 Use divergence theorem to evaluate $\iint_S \vec{F} \cdot \hat{n} ds$ where $\vec{F} = x^3 \hat{i} + y^3 \hat{j} + z^3 \hat{k}$ and S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$.
