



**KERALA AGRICULTURAL UNIVERSITY**  
**B.Tech. (Ag. Engg.) 2017 Admission**  
**I Semester Final Examination-January-2018**

Sacs.1101

Engineering Mathematics I (2+1)

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

**I Fill in the blanks:**

- 1  $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$  is .....
- 2 If  $f(x, y) = xy^2 - \cos y$ , then the value of the partial derivative  $\frac{\partial f}{\partial x}$  is.....
- 3 The degree of the homogeneous function  $f(x, y) = \frac{x^4 + y^4}{x + y}$  is .....
- 4 If two functions are functionally dependent then their Jacobian is .....
- 5  $\iint_R dx dy$  represent ..... of the region R.
- 6 The degree of the differential equation  $\frac{d^2y}{dx^2} - 3 \left(\frac{dy}{dx}\right)^2 + y = 0$  is .....
- 7 The solution of the differential equation  $(D^2 - 4)y = 0$  is .....
- 8 The Particular integral of the differential equation  $(D + 5)y = e^{2x}$  is .....
- 9 If  $\phi(x, y, z) = x^2 + y^2 + z^2$ , then the gradient  $\nabla \phi$  is .....
- 10 If  $F$  is a vector field with  $\text{curl } F = 0$ , then the vector  $F$  is said to be .....

**II Write Short notes on any FIVE of the following .** **(5x2=10)**

- 1 Find the Maclaurin's series of  $f(x) = e^x$
- 2 If  $u = x^2 - y$ ,  $v = x + y$ , then find the Jacobian of  $u$  and  $v$  with respect to  $x$  and  $y$ .
- 3 Show that  $(x^2 - 4xy - 2y^2)dx + (y^2 - 4xy - 2x^2)dy$  is an exact differential equation.
- 4 If  $u = x^2 + y^2$ , with  $x = a \cos t$ ,  $y = b \sin t$  find  $\frac{du}{dt}$ .
- 5 Evaluate  $\int_0^1 \int_0^2 (x + 3) dx dy$
- 6 State Stoke's Theorem.
- 7 If  $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ , then evaluate  $\text{div } \vec{r}$ .

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

- 1 If  $u = e^{x^3 + y^3}$ , prove that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 3u \log u$
- 2 Find the maxima and minima of  $x^3 + y^3 + 3xy$ .
- 3 Change the order of integration and hence evaluate  $\int_0^1 \int_x^1 \frac{x}{x^2 + y^2} dy dx$

- 4 Use triple integrals to find the volume bounded by the cylinder  $x^2 + y^2 = 9$ , the planes  $z = 1$  and  $x + z = 5$ .
- 5 Solve the Bernoulli's differential equation:  $x \frac{dy}{dx} + y = xy^3$ .
- 6 Solve  $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$  using the method of variation of parameters.
- 7 Use Green's Theorem to evaluate  $\oint_C (x - 2y)dx + (3x - y)dy$ , where  $C$  is the boundary of a unit square

**IV Write an essay on any one of the following (1x10=10)**

- 1 Solve the Legendre's linear equation:

$$(3x + 2)^2 \frac{d^2y}{dx^2} + 3(3x + 2) \frac{dy}{dx} - 36y = 3x^2 + 4x + 1$$

- 2 Verify Gauss divergence theorem for  $\vec{F} = (x + y)\hat{i} + x\hat{j} + x\hat{k}$  taken over the cube bounded by  $x = 0, x = 1, y = 0, y = 1, z = 0, z = 1$ .

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