Assignment 1

Engineering Mathematics-II

Branch: Electrical Engineering, Civil Engineering

Last date of submission: 03/02/2019

Course Teacher: Dr. SURENDER SINGH

(1) Prove that

$$\nabla(\overline{A}\cdot\overline{B}) = \overline{A}\times(\nabla\times\overline{B}) + \overline{B}\times(\nabla\times\overline{A}) + (\overline{A}\cdot\nabla)\overline{B} + (\overline{B}\cdot\nabla)\overline{A}.$$

(2) What is the physical significance of curl of a vector field.

(3) Prove that $\nabla\times(f\,\nabla g) = \nabla f\times\nabla g) = -\nabla\times(g\,\nabla f)$ and deduce that $\nabla\times(f\,\nabla f) = 0$.

(4) Prove that $\nabla^2(gh) = g\,\nabla^2 h + h\nabla^2 g$.

(5) Derive area enclosed by a closed curve using Green's theorem.

(6) Evaluate $\iint_S (\nabla\times\overline{F})\bullet\overline{n}\,dS$ where $\overline{F} = yi + (x-2xz)j - xyk$ and S is the surface of the sphere $x^2+y^2+z^2=a^2$ above the xy-plane.

(7) Verify Stoke's theorem for $\hat{A} = y^2\,\hat{i} + xy\,\hat{j} - xz\,\hat{k}$ where S is the hemisphere $x^2+y^2+z^2=a^2$, $z\geq 0$.

(8) Using Gauss divergence theorem evaluate the integral $\iint_S yz\,dy\,dz + zx\,dz\,dx + xy\,dx\,dy$ where S: $x^2+y^2+z^2=4$.

(9) Interpret the divergence of a vector field in various physical situations.

(10) Write a note on the applicability of Gauss divergence theorem and Stoke's theorem.

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Mathematics

B.Tech. (CSE/ECE/ME/EE/Civil) Minor Examination (Even Semester) 2018-19

Entry No: 18BCS064 **Total Number of Pages: [01]**

Date: 05/02/2019 **Total Number of Questions: [03]**

Course Title: Engineering Mathematics-II

Course Code: MTL 1022/1026

Time Allowed: 1.30 Hours (9.15 A.M.-10.45 A.M.) **Max Marks: [20]**

NOTE

i. Attempt All Questions.

ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.

iii. Assume an appropriate data / information, wherever necessary / missing.

Q1.	(a) Prove that $\int_C \mathbf{r}.d\mathbf{r} = 0$.	[02]	CO1
	(b) Find the directional derivative of the function $f(x,y,z) = 3x^3 + 2xy^2 + xyz$ along the direction $2\,\hat{\imath} + 4\hat{\jmath} + 4\hat{k}$ at a point (1,1,1).	[02]	CO1
	(c) Find the work done by a particle moving along the curve $y^2=x$, from the point (0,0) to the point (1,1) under the force $\overline{F} = (x^2+xy)\boldsymbol{i} + (x^2+y^2)\boldsymbol{j}$.	[02]	CO2
Q2.	(a). Show that $r^n\boldsymbol{r}$ is solenoidal if n = -3.	[03]	CO2
	(b) A particle moves along a curve $x = e^{-t}, y = 2\cos 3t$, $z = 2\sin 3t$, where t is the time variable. Determine magnitude of its velocity and acceleration at t=0.	[03]	CO1
Q3.	(a) Verify Greens theorem in the xy-plane for $\oint_c (xy + y^2)dx + x^2dy$; where c is closed curve of the region bounded by $y=x$ and $y=x^2$.	[04]	CO2
	(b). Use Stokes' theorem to evaluate $\iint_S \text{curl}\,\mathbf{F}.\mathbf{n}\,dS$ over the upper half of the hemisphere of radius a, center at the origin, if $\boldsymbol{F} = 2y\ \boldsymbol{i} - x\ \boldsymbol{j} + z\,\boldsymbol{k}$.	[04]	CO2

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Mathematics

B.Tech. (CSE/ECE/ME/EE/Civil), Minor II Examination (Even Semester) 2018-19

Entry No: 1 8 B C S 0 6 4 | Total Number of Pages: [01]

Date: 17/03/2019 | Total Number of Questions: [04]

Course Title: Engineering Mathematics-II

Course Code: MTL 1026

Time Allowed: 1.30 Hours (9.15 A.M.-10.45 A.M.) | **Max Marks: [20]**

NOTE

i. Attempt All Questions.
ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
iii. Assume an appropriate data / information, wherever necessary / missing.

Q1.	(a) Derive the differential equation of all circles with centre at any point and radius is a.	[02]	CO3
	(b) What is order and degree of differential equation $x^2\left(\frac{d^2y}{dx^2}\right)^6 + y^{-2/3}\left\{1+\left(\frac{d^3y}{dx^3}\right)^5\right\}^{1/2} + \frac{d^2}{dx^2}\left\{\left(\frac{d^2y}{dx^2}\right)^{-2/3}\right\} = 0.$	[02]	CO3
Q2.	(a) Find the solution of differential equation $y(2xy+e^x)dx = e^x dy$.	[03]	CO4
	(b) Solve differential equation $y\sin 2x\, dx - (1+y^2+cos^2 x)dy = 0$.	[03]	CO4
Q3.	(a) Find the solution of differential equation $y\sin 2x\, dx - (1+y^2+cos^2 x)dy = 0$. $x\,dy - y\,dx = \sqrt{x^2-y^2}\,.\,dx$	[03]	CO4
	(b) Find the solution of differential equation $(1+y^2)\,dx = (tan^{-1}y - x)\,dy$.	[03]	CO4
Q4.	Solve $(2xy^4e^y + 2xy^3 + y)dx + (x^2y^4e^y - x^2y^2 - 3x)dy = 0$	[04]	CO4
	OR		
	Solve the differential equation $(2x^2+3y^2-7)x\,dx - (3x^2+2y^2-8)y\,dy = 0$	[04]	CO4

COURSE OUTCOMES:

1. understand the concepts of vector calculus like directional derivative, gradient, divergence and curl, and their applications.
2. learn and apply the concepts of vector integral calculus for the computation of work done, circulation, and flux.
3. formulate the differential equations concerning physical phenomena like electric circuits, wave motion, heat equation etc.
4. learn various methods of solution of ordinary and partial differential equations.
5. solve various partial differential equations arising in heat conduction problems and wave propagation problems.

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Mathematics

B.Tech. (Mathematics); II-Sem. Major Examination, May. 2019 (Even Semester)

Entry No: 1 8 B C S 0 6 4 **Total Number of Pages: [02]**

Date:14/05/2019 **Total Number of Questions: [05]**

Course Title: Engineering Mathematics-II

Course Code: MTL-1022/1026

Time Allowed: 3.00 Hours **Max Marks: [50]**

NOTE

i. Attempt All Questions.

ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.

iii. Assume an appropriate data / information, wherever necessary / missing.

	Section - A		
Q1.	(a) Define gradient, divergence and curl with suitable examples.	[02]	CO1
	(b) If $\overline{F} = 3xy\hat{i} - y^2\hat{j}$, evaluate $\int_C \overline{F}.d\overline{r}$, where C is the curve $y = 2x^2$ in the *xy*-plane, from *(0,0)* to *(1,2)*.	[02]	CO2
	(c) Form PDE via eliminating *a* and *b* from $z = axe^y + \frac{1}{2}a^2e^{2y} + b$.	[02]	CO3
	(d) Find the solution of differential equation $\frac{dx}{y+z} = \frac{dy}{-x-z} = \frac{dz}{x+z}$.	[02]	CO4
	(e) Define linear and nonlinear partial differential equations with examples.	[02]	CO4
Q2.	(a) Find the solution of differential equation $(x^3 + y^3)dx = (x^2y + xy^2)dy$.	[03]	CO3
	(b) Solve $\left(y + \frac{y^3}{3} + \frac{x^2}{2}\right)dx + \frac{1}{4}(x + xy^2)dy = 0$.	[03]	CO3
	(c) Evaluate $\iint_S \overline{F}.\hat{n}\,dS$, where $\overline{F} = (2x+3z)\hat{i} - (xz+y)\hat{j} + (y^2+2z)\hat{k}$ and S is the surface of the sphere having centre centre (3,-1,2) and radius 3.	[03]	CO2
	(d) Solve differential equation $\frac{dx}{x^2 - y^2 - yz} = \frac{dy}{x^2 - y^2 - zx} = \frac{dz}{z(x-y)}$.	[03]	CO4
	Section - B		
Q3.	(a) Using the method of variation of parameters, solve $y'' - 6y' + 9y = x^2e^{3x}$.	[04]	CO4
	(b) Using method of separation of variables find the solution of wave equation $\frac{\partial^2 u}{\partial t^2} = c^2\frac{\partial^2 u}{\partial x^2}$.	[04]	CO5
	(c) Find the solution of differential equation $(D^2 - 2D + 1)y = xe^x \sin x$.	[04]	CO4
Q4.	(a) Show that $curl\ \frac{\overline{a} \times \overline{r}}{r^3} = -\frac{\overline{a}}{r^3} + \frac{3(\overline{a}.\overline{r})\overline{r}}{r^5}$.	[05]	CO1

	OR		
	Find the solution of differential equation $(D^3-3D-2)y=540x^3e^{-x}$.	[05]	CO4
	(b) Evaluate $\iint_S (yz\hat{i}+xz\hat{j}+xy\hat{k}).dS$, where S is the surface of the sphere $x^2+y^2+z^2=1$, in the first octant.	[05]	CO2
	OR		
	Find the solution of partial differential equation $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u$ by the method of separation of variables where $u(x,0)=6e^{-x}$.	[05]	CO4
Q5.	(a) A homogeneous rod of conducting material of length 100 cm has its ends kept at zero temperature and the initial temperature is: $u(x,0)=\begin{cases} x: & 0\le x\le 50 \\ 100-x: & 50\le x\le 100 \end{cases}$ Find the temperature $u(x,t)$ at any time.	[06]	CO5
	OR		
	Verify the Gauss's divergence theorem for the vector field $\overline{F}=(xy\hat{i}+z^2\hat{j}+2yz)\hat{k}$, defined in the tetrahedron bounded by the planes $x=0$, $y=0$, $z=0$ and $x+y+z=1$, then evaluate $\iint_S \overline{F}.\hat{n}\,dS$.	[06]	CO2

Course Outcomes

CO1. Understand the concepts of vector calculus like directional derivatives, gradient, divergence and curl, and their applications.

CO2. Learn and apply concepts of vector inegral calculus for the computation of work done, circulation and flux.

CO3. Formulate the differential equations concerning physical phenomenon like electric circuits, wave motion, heat equation etc.

CO4. Learn various methods of solution of ordinary and partial differential equations.

CO5. Solve various partial differential equations arising in heat conduction problems and wave propagation problems.