Registration No : 2 2 0 1 2 1 4 0 6 5

Total Number of Pages : 02

B. Tech./
Integrated Dual Degree (B. Tech & M.Tech)
RMA2A001

2nd Semester Regular/Back Examination: 2022-23
Mathematics II
All branches
Time : 3 Hour
Max Marks : 100
Q. Code : M442

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions : (2 x 10)

a) Write the definition of a basis for a vector space V.

b) Under what condition a nonhomogeneous system of m linear equations in n unknowns will have no solution?

c) If $A = \begin{pmatrix} 1 & 0 & 0 \\ 1 & -2 & 0 \\ 3 & 1 & 4 \end{pmatrix}$, what are the eigenvalues of the matrix A?

d) Eigen values of skew-symmetric matrices are either______ or ________.

e) Express the straight line parametrically which passes through the point (2, -1, 4) in the direction of the vector (1, 2, -1).

f) Find curl of $\bar{F} = x^2\hat{i} + y^2\hat{j} + z^2\hat{k}$.

g) State Green's Theorem in a plane.

h) Find the surface normal $\bar{N}$ to the surface f(x, y ,z)= $x^2 + y^2 - z^2$.

i) What is the fundamental period of the function $\cos \pi x$?

j) Define Fourier series of a function f(x) in $(-\pi, \pi)$.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 × 8)

a) Solve the equations 4y +3z = 8; 4x – 2z = 10; 3x +2y = 5 by any suitable method.

b) Find the inverse of the matrix $\begin{pmatrix} 4 & 2 & 1 \\ 3 & 2 & 5 \\ 2 & 0 & 5 \end{pmatrix}$.

c) Show that the product of two orthogonal matrix is orthogonal.

d) Diagonalize the matrix $\begin{pmatrix} 2 & 3 \\ 5 & 1 \end{pmatrix}$.

e) Show that the eigenvalues of Hermitian matrix is always real.

f) Find the directional derivative of the function $f(x,y,z)=e^x+e^y+e^z$ at the point P(-4, 2, 3) in the direction $\vec{a}=[1,\ 2,\ 1]$

g) Find the area bounded by the line $y=x$ and the curve $y=x^2$.

h) Evaluate $\int_C \vec{F}(\vec{r}).d\vec{r}$ where $\vec{F}=[1,\ y,\ z]$ and C: $\vec{r}=[t, \cos t, \sin t]$ from $(0,\ 1,0)$ to $(\pi/2,\ 0,\ 1)$.

i) Use Stokes' theorem to compute $\oiint_S curl\vec{F}.d\bar{S}$ where $\vec{F}=x^2\hat{i}+2x\hat{j}+2z\hat{k}$ and S is the surface given by $x^2+\frac{y^2}{4}+\frac{z^2}{a^2}=1,\quad z\geq 0.$

j) Find the Fourier series of the given function $f(x)=\begin{cases} k, & -\pi<x<0 \\ -k, & 0<x<\pi \end{cases}$

k) Find the Fourier cosine transform and Fourier sine transform of $f(x)=\begin{cases} 5, & -1<x<1 \\ 0, & otherwise \end{cases}$

l) Show by Fourier integral that $\int_0^\infty \frac{\cos wx + w\sin wx}{1+w^2}dw=\begin{cases} 0, & x<0 \\ \pi e^{-x}, & x>0 \end{cases}$

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Solve the system of equations $2x_1 + x_2 - 2x_3 + 2x_4 = 5$; $4x_1 + 5x_2 - 3x_3 + 6x_4 = 9$; $-2x_1 + 5x_2 - 2x_3 + 6x_4 = 4$; $4x_1 + 11x_2 - 4x_3 + 8x_4 = 2$. **(16)**

Q4 Find the eigenvalues and eigenvectors of the matrix $\begin{pmatrix} -2 & -4 & 2 \\ -2 & 1 & 2 \\ 4 & 2 & 5 \end{pmatrix}$. **(16)**

Q5 Find the Fourier series of the function $f(x)=\begin{cases} 0, & -2<x<0 \\ 2x, & 0<x<2 \end{cases}$ with period 4. **(16)**

Q6 Evaluate $\oiint_S \vec{F}.\vec{n}\,dA$ where $\vec{F}=[6x,\ 0,\ -2z]$, over the sphere S: $x^2+y^2+z^2=4$ (i) directly and (ii) using Gauss Divergence theorem. **(16)**

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B. Tech.
RMA2A001

2^{nd} Semester Regular / Back Examination: 2021-22
MATHEMATICS - II
BRANCH(S): AEIE, AERO, AG, AME, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, CSEAI, CSEAIME. CST, ECE, EEE, ELECTRICAL. ELECTRICAL & C.E, ELECTRONICS & C.E, ENV, ETC, IT, MANUTECH, MECH, METTA, MINERAL, MINING, MME, PLASTIC, PT
Time : 3 Hour
Max Marks : 100
Q.Code : J671

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions : **(2 × 10)**

a) Under what condition a system of m linear equations in n unknowns will have a solution?

b) When a set of vectors from a vector space is called a linearly independent set?

c) What are the eigen values of the matrix $\begin{pmatrix} 2 & 1 & -1 \\ 0 & 3 & 5 \\ 0 & 0 & -1 \end{pmatrix}$?

d) Which types of matrices have their eigen values with unit modulus?

e) Express the straight line parametrically which passes through the point (2, 3, 4) in the direction of the vector [1, 2, 1].

f) Find the gradient of the scalar function $f(x, y, z) = xy^2z$.

g) Find the divergence of the vector function $\vec{F} = [x^2yz, xy^2z, xyz^2]$

h) Find the surface normal $\vec{N}$ to the surface $\vec{r}(u,v) = [a\cos v, b\sin v, u]$.

i) What is the fundamental period of the function $\cos 5x$?

j) What is the Fourier series of the function $\sin^2 x$?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) **(6 × 8)**

a) Solve the equations x + y + z = 6; 2x – 3y + 4z = 8; x – y + 2z = 5 by any suitable method

b) Find the inverse of the matrix $\begin{pmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{pmatrix}$.

c) Show that the eigen values of a Hermitian matrix is always real.

d) Diagonalize the matrix $\begin{pmatrix} 3 & 4 \\ 2 & 5 \end{pmatrix}$.

e) Find the eigen values of the matrix $\begin{pmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{pmatrix}$

f) Find the directional derivative of the function $f = (x^2 + y^2 + z^2)^{-1/2}$ at the point P(4, 2, −4) in the direction $\vec{a} = [1, 2, -2]$

g) Find the area bounded by the cardioid $r = a(1 + \sin\theta)$.

h) Evaluate $\int_C \vec{F}(\vec{r}).d\vec{r}$ where $\vec{F} = [y^2, x^2, \cos^2 z]$ and C: $\vec{r} = [\cos t, \sin t, t]$ from (1, 0, 0) to (1, 0, 4π)

i) Evaluate $\int_C \vec{F}(\vec{r}).d\vec{r}$ using Green's theorem where $\vec{F} = [-e^y, e^x]$ and C is the boundary of the triangle with vertices (0, 0), (2, 0) and (2, 1) in counterclockwise sense.

j) Find the Fourier series of the given function which is periodic with period 2π.
$f(x) = x, -\pi < x < \pi$

k) Find the Fourier cosine series of $f(x) = x^2, 0 < x < \pi$.

l) Show by Fourier integral that $\int_0^\infty \frac{\cos xw}{1+w^2} dw = \frac{\pi}{2} e^{-x}$ if $x > 0$

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Solve the given set of linear equations **(16)**

$3x_1 + x_2 - 2x_3 + 4x_4 = 2$; $2x_1 - x_2 + x_3 - 3x_4 = 2$; $x_1 + 2x_2 - 3x_3 + 7x_4 = 0$

Q4 Find the eigen values and eigen vectors of the matrix $\begin{pmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 2 \end{pmatrix}$. **(16)**

Q5 Find the Fourier series of the function $f(x) = \begin{cases} 0, & -1 < x < 0 \\ x, & 0 < x < 1 \end{cases}$ with period 2. **(16)**

Q6 Evaluate $\oiint_S \vec{F}.\vec{n}\, dA$ where $\vec{F} = [2xy, yz^2, xz]$, S is the surface of the volume bounded by x = 0, y = 0, z = 0 and x + y + z = 1.. **(16)**

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B.Tech
RMA2A001

2nd Semester Regular/Back Examination 2018-19
MATHEMATICS-II
BRANCH : AEIE, AERO, AG, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, IT, MANUTECH, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, PT
Max Marks : 100
Time : 3 Hours
Q.CODE : F131

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1 Only Short Answer Type Questions (Answer All-10) (2 x 10)

a) Determine value of x for which the matrix $A = \begin{bmatrix} 8 & x & 0 \\ 4 & 0 & 2 \\ 12 & 6 & 0 \end{bmatrix}$ is singular?

b) If a non-homogeneous system of n equations with n unknowns has unique solution, then what is the rank of coefficient matrix?

c) Determine Eigen values of the matrix $A = \begin{bmatrix} 1 & 0 & 0 \\ -1 & 2 & 0 \\ 2 & 3 & 3 \end{bmatrix}$.

d) Define Hermitian matrix and give an example of it.

e) If $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$, then determine $div(\vec{r})$.

f) State whether the vector $\vec{v} = yz\hat{\imath} + zx\hat{\jmath} + xy\hat{k}$ is irrotational or not.

g) Derive directional derivative of $f = xyz$ at $P:(-1,1,3)$ in the direction $\vec{a} = \hat{\imath} - 2\hat{\jmath} + 2\hat{k}$.

h) State Gauss Divergence theorem.

i) Determine values of a_0 and a_n in the Fourier expansion of $f(x) = sinx, -\pi < x < \pi$.

j) The function $f(x) = x + cosx$ is even function or odd function or neither even nor odd. Justify your answer.

Part- II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

a) Calculate rank of the given matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 5 & 7 \end{bmatrix}$.

b) Explain that product of two unitary matrices is unitary.

c) Solve the system of equations $x + y - z = 9, 8y + 6z = -6, -2x + 4y - 6z = 40$ by using Gauss Elimination method.

d) Calculate inverse of matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$ by Gauss Jordan method.

e) For any scalar function f(x,y,z) and vector function $\vec{v} = [v_1, v_2, v_3]$, Prove that
   i. $Curl(grad\, f) = 0$
   ii. $Div(curl\, \vec{v}) = 0$

f) Calculate length of the curve $\vec{r}(t) = acost\,\hat{\imath} + asint\,\hat{\jmath} + 4t\,\hat{k}$ from $(a,0,0)$ to $(a,0,8\pi)$.

g) Formulate Fourier Cosine transform and Fourier Sine transformation of

$$f(x) = \begin{cases} 1, 0 \le x < 1 \\ 0, \quad x \ge 1 \end{cases}$$

h) Develop Half range Fourier Cosine series of the function $f(x) = x^2$,$0 < x < 2$.

i) Evaluate the integral
$\int_C (y^2 dx - x^2 dy)$,C: Straight line segment from $(0,0)$ to$(1,1)$.

j) Design Fourier series of $f(x) = |x|, -2 < x < 2$,$p = 4$.

k) Explain that the given line integral

$$\int_{(0,2,3)}^{(1,1,1)} yz \sinh xz\, dx + \cosh xz\, dy + xy \sinh xz\, dz$$

is independent of path and hence find the value of integral.

l) Calculate unit normal vector of the surface $r(u,v) = [u \cos v, u \sin v, u^2]$.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Diagonalize $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$. **(16)**

Q4 Evaluate eigen values and eigen vectors for the given matrix, **(16)**

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}.$$

Q5 Verify Stokes's theorem for $F = [x, y, z]$ and surface S the paraboloid $z = f(x,y) = 1 - (x^2 + y^2), z \geq 0$. **(16)**

Q6 a) Using Fourier integral representation, Prove that **(10)**

$$\int_0^\infty \frac{\cos x\omega + \omega \sin x\omega}{1 + \omega^2} d\omega = \begin{cases} 0, & if\ x < 0 \\ \dfrac{\pi}{2}, & if\ x = 0 \\ \pi e^{-x}, & if\ x > 0 \end{cases}$$

b) Evaluate Fourier series of $f(x) = x^2, -\pi < x < \pi$. **(6)**

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Total Number of Pages : 02 **B.Tech**
BS1104

2^{nd} Semester Back Examination 2018-19
MATHEMATICS - II
BRANCH : CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, IT, MECH, PLASTIC
Time : 3 Hours
Max Marks : 70
Q.CODE : F044
Answer Question No.1 which is compulsory and any FIVE from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions :** **(2 x 10)**

a) Determine the Laplace Transform of $f(t) = (t+1)^2 e^t$

b) Derive the parametric representation of the straight line through the point $A(4,2,0)$ in the direction of the vector $b = \hat{\imath} + \hat{\jmath}$

c) What is the divergence of the vector $v = e^x(cosy\,\hat{\imath} + siny\hat{\jmath})$

d) If $f(x,y) = x^2\cos y$ then what is the value of $\nabla^2 f$at $(0,0)$.

e) Find $\nabla^2 f \ where \ f = e^{2x}cos2y$.

f) State Dirac's delta function.

g) State the functions which are even, odd or neither even or odd out of the following functions

$$x + x^2, \quad \ln x \ , \quad x\sin x\ , \ |x|$$

h) Find curl of of the vector $v = yz\hat{\imath} + 3zx\hat{\jmath} + z\hat{k}$ at the point *(0 ,2, 5)*

i) Derive the unit normal vector to the surface $x^2 + y^2 + z^2 = 1$

j) Using Green's theorem find area of an ellipse.

Q2 a) Using Laplace transformation, solve the equation **(5)**

$$y'' + y = r(t), \qquad r(t) = t \ if \ 1 < t < 2 \ and \ 0 \ otherwise.$$
$$y(0) = 0, \qquad Y'(0) = 0$$

b) Show that the form under the integral sign is exact in the plane and evaluate the integral **(5)**

$$\int_{(0,-1,1)}^{(2,4,0)} e^{x-y+z^2}(dx - dy + 2zdz)$$

Q3 a) Find the directional derivative of the function $f = \ln(x^2 + y^2)$ at the point $P(4,5)$ in the direction of the vector $a = \hat{\imath} - \hat{\jmath}$ **(5)**

b) Using Convolution, calculate the value of $L^{-1}\left[\frac{1}{s^2(s^2+1)}\right]$ **(5)**

Q4 a) Using Gamma function evaluate $\int_0^\infty x^6 e^{-3x} dx$. **(5)**

b) Find the Fourier Transformation of $f(x) = \begin{cases} xe^{-x}, & x > 0 \\ 0, & x < 0 \end{cases}$ **(5)**

Q5 a) Find the Fourier cosine integral of $f(x) = e^{-kx} \qquad (x > 0, k > 0)$ **(5)**

b) Find the Fourier series of the function $f(x) = 2x$, $(-1 < x < 1)$ with period 2. **(5)**

Q6 Using the Fourier series of $f(x) = \frac{x^2}{2}$, $(-\pi < x < \pi)$ Prove that **(10)**

$$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \frac{1}{25} + \cdots \ldots\ldots\ldots = \frac{\pi^2}{6}$$

Q7 Define stokes theorem and evaluate the line integral $\int_C F.r'(s)ds$ where **(10)**

$$F = [4z, \quad -2x, \quad 2x], \; C\text{: the ellipse} x^2 + y^2 = 1. \quad z = y + 1$$

Q8 **Write short answer on any TWO :** **(5 x 2)**

a) What is Jacobian and why it is used. Also write its polar form.

b) Find the value of Γ(5/2).

c) Find the volume of the region beneath $z = 4x^2 + 9y^2$ and above the rectangle with vertices $(0,0)$, $(3,0)$, $(3,2)$, $(0,2)$

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Total Number of Pages : 02 **B.Tech.**
BS1104

2^{nd} Semester Back Examination 2017-18
MATHEMATICS-II
BRANCH : AEIE, AERO, AUTO,
BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH, MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE
Time : 3 Hours
Max Marks : 70
Q.CODE : C601
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.
Answer all parts of a question at a place.

Q1 **Answer the following questions :** **(2 x 10)**

a) Find $L[e^{-t}\cos 2t]$.

b) Find $L[f(t)]$, Where $f(t) = \begin{cases} 4; 0 < t < 1 \\ 5; 2 < t < 4 \\ 6; \quad t > 4 \end{cases}$

c) The Fourier sine transformation of the function f(x)= x^2 if 0< x <1 and f(x) = 0 if x > 1 .

d) Find the Directional derivative of the function f $= x - y$ at a point p $(4,5)$ in the direction $\vec{a} = 2\hat{\imath} + \hat{\jmath}$

e) Find the Laplace transformation of the unit impulse function $\delta(t-1)$ *and* The unit step function $U(t-5)$.

f) What is the value of $\iint_R 2\,dx\,dy\,, R: 0 \le x \le 1, 0 \le y \le \sqrt{1-x^2}$?

g) Find the unit normal vector of the surface $x^2 - y^2 + z^2 = 1$

h) Evaluate $L^{-1}\left[\frac{1}{(s^2+1)(s+1)}\right]$.

i) Find the value of $e^{3t} * e^{2t}$.

j) Find $\nabla^2 f$ *where* $f = e^{2x} sin 2y$.

Q2 **a)** Solve the following initial value problem using Laplace transformation $\frac{d^2y}{dt^2} - \frac{dy}{dt} - 2y = 4x^2$ *with* $y(0) = 1, y'(0) = 4$? **(5)**

b) Solve the following integral equation using Laplace transformation $t = 1 + \int_0^t \sin(t-u)y(u)du.$ **(5)**

Q3 **a)** Find the coordinates of the center of gravity of a mass of density f$(x,y) = 1$ in the region R : the triangle with vertices $(0,0), (b,0)$ *and* (b,h) . **(5)**

b) Prove that $L\left(\frac{\sin \alpha t}{t}\right) = \cot^{-1}\left(\frac{s}{\alpha}\right), \alpha > 0$ **(5)**

Q4 **a)** Find the Fourier series expansion of $f(x) = \begin{cases} x & if \quad 0 < x < 1 \\ 1-x & if \quad 1 < x < 2 \end{cases}$ of period p = 2 . **(5)**

b) Find the Fourier series expansion of $f(x) = \begin{cases} x \;\; if -\frac{\pi}{2} < x < \frac{\pi}{2} \\ 0 \;\; if \quad \frac{\pi}{2} < x < \frac{3\pi}{2} \end{cases}$ **(5)**

Q5 **a)** Find $\oint_S F \cdot n\, ds$ where F= $z\hat{i} + x\hat{j} - yz\hat{k}$ and s be the surface of the cylinder $x^2 + y^2 = 9$ included in the first octant between $z = 0\ and\ z = 4$. **(5)**

b) Find the total Mass of a mass distribution of density f$(x, y, z) = e^{-x-y-z}$ in a region T: 0$\leq x \leq 1 - y, 0 \leq y \leq 1, 0 \leq z \leq 2$ **(5)**

Q6 **a)** Using Green's Theorem find the line integral **(5)**

$\oint_C (y\,dx - xdy)$, Where, 'C' is the circle$x^2 + y^2 = \frac{1}{4}$.

b) Find the area of the region in the first quadrant under the arc of the Limaconr= $1 + 2\cos\theta$; 0$\leq \theta \leq \frac{\pi}{2}$. **(5)**

Q7 Prove that the integral$\int_0^\infty \frac{\cos\omega x + \omega \sin\omega x}{1+\omega^2} d\omega = \begin{cases} 0\ ; & x < 0 \\ \frac{\pi}{2}\ ; & x = 0 \\ \pi e^{-x}\ ; & x > 0 \end{cases}$ **(10)**

Q8 **Write short answer on any TWO :** **(5 x 2)**

a) Find $L[t^2 \sin 2t]$.

b) Evaluate $L^{-1}\left[\frac{s+4}{(s^2+4s+8)}\right]$.

c) Find $\Gamma(-\frac{9}{2})$.

d) Find the Fourier cosine series expansion of $f(x) = 2 - x\ (0 < x < \pi)$.

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B.Tech
15BS1104

2nd Semester Back Examination 2018-19
MATHEMATICS - II
BRANCH : AEIE, AERO, AUTO, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ETC, FAT, IEE, IT, MECH, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE
Max Marks : 100
Time : 3 Hours
Q.CODE : F130

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1 **Only Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) Write Laplace Transform of Unit step function.
b) $L(f * g) =$ ________ .
c) Write the relation between beta and gamma function.
d) If $f(x) = x^2, -\pi < x < \pi$, then the value of Fourier coefficient $b_n =$ ______.
e) Determine Inverse Laplace transform of $\frac{s}{s^2+9}$.
f) $F(x) = x + \sin x$ is even function or odd function. Justify your answer.
g) Derive gradient of $f(x, y, z) = \cos xyz + xy$.
h) Determine a normal vector n of $z^2 = 4(x^2 + y^2)$ at the point $P: (1,0,2)$.
i) State Stokes's theorem.
j) State whether the vector $\vec{v} = yz\hat{\imath} + zx\hat{\jmath} + xy\hat{k}$ is irrotational or not.

Part- II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Calculate Laplace transform of
 i. $t \sin at$
 ii. $e^{2t} \cos 4t$
b) Solve the integral equation $y(t) = t + \int_0^t y(u) \sin(t-u)\,du$.
c) Calculate Inverse Laplace transform of $\frac{1}{s(s+1)(s+2)}$.
d) Formulate $Y(s)$ for the given initial value problem $y'' + 2y' + 5y = 1, y(0) = 0, y'(0) = 1$.
e) Calculate Fourier series of $f(x) = x^2, -\pi < x < \pi, p = 2\pi$.
f) Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.
g) Determine length of the curve $\vec{r}(t) = 2\cos t\,\hat{\imath} + 2\sin t\,\hat{\jmath} + 3t\,\hat{k}$ from $(2,0,0)$ to $(2,0,6\pi)$
h) For any scalar function f(x,y,z) and vector function $\vec{v} = [v_1, v_2, v_3]$, Prove that
 i. $Curl(grad\, f) = 0$
 ii. $Div(curl\, \vec{v}) = 0$
i) Calculate unit normal vector of the surface $r(u,v) = [u \cos v, u \sin v, u^3]$.
j) Explain, the given differential $3x^2 dx + 2yz\, dy + y^2\, dz$ is exact or not.
k) Evaluate the integral :
 $\int_C y^3 dx + x^3 dy)$, C: Straight line segment from $(0,0)$ to$(1,1)$.
l) Develop Fourier Cosine transformation of $f(x) = e^{-kx}, k > 0, x > 0$.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Evaluate solution of initial value problem $y'' - 4y' + 3y = 6t - 8, y(0) = 0, y'(0) = 0$ by using Laplace transformation. **(16)**

Q4 a) Evaluate Fourier integral representation of $f(x) = \begin{cases} 0, & if\ x < 0 \\ \frac{1}{2}, & if\ x = 0 \\ e^{-x}, & if\ x > 0 \end{cases}$. **(10)**

b) Evaluate Fourier sine transform of $f(x) = \begin{cases} 1, & 0 \le x < 1 \\ 0, & x \ge 1 \end{cases}$. **(6)**

Q5 Prove that the integral : **(16)**

$$\int_C [\, 2xyz^2\, dx + (x^2z^2 + z\cos yz)dy + (2x^2yz + y\cos yz)dz\,]$$

Is independent of path in any domain and hence find the value of I from $A{:}(0,0,1)$ to $(1, \frac{\pi}{4}, 2)$.

Q6 Verify Green's theorem for the given integral. **(16)**

$\int_C [(xy + y^2)dx + x^2dy]$, Where C is bounded by the curve $y = x$ and $y = x^2$.

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Total Number of Pages : 02 **B.Tech.**
15BS1104

2nd Semester Back Examination 2017-18
MATHEMATICS-II
BRANCH : AEIE, AERO, AUTO,
BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH, MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE
Time : 3 Hours
Max Marks : 100
Q.CODE : C600
Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.
Answer all parts of a question at a place.

Part – A (Answer all the questions)

Q1 Answer the following questions: ***multiple type or dash fill up type:*** **(2 x 10)**

a) What is the Fundamental period of $f(x) = \sin(2018x + 2015)$
(a) $\frac{2\pi}{2015}$ (b) $\frac{2\pi}{2016}$ (c) $\frac{2\pi}{2018}$ (d) none

b) What is the value of $L[\delta(t)]$,where $\delta(t)$ is the unit impulse function
(a) 0 (b) 10 (c) 100 (d) none

c) The value $of \iint_R f(x,y)dxdy$, where $f(x,y) = x; R: 0 \le x \le 1, 0 \le y \le 2$ is__________________.

d) $L^{-1}[\frac{1}{(s-5)^2}]$ =_____________.

e) The curl of $xyz^2 i + yzx^2 j + zxy^2 k \; at \; (1,2,3)$ is____________.

f) Let $U(t)$ be the unit step function then, the Laplace transformation of $f(t) = (t-5)U(t-5)$ is______________.

g) What is the coefficient of $\cos nx$ in Fourier series expansion of
The function $f(x) = \frac{\pi^2}{12} - \frac{x^2}{12}$ in $(-\pi, \pi)$
a)$1-(-1)^n$ (b) π (c) 0 (d) none

h) The Fourier sine transformation of the function f(x)= e^{-2x} is ___________.

i) The value of Convolution $2 * \sin 2t$ is__________.

j) Let $f(x,y,z)$ be any scalar function then grad $[f(x,y,z)]$ is a
(a) Scalar function (b) vector function (c) constant function (d) none

Q2 Answer the following questions: ***Short answer type:*** **(2 x 10)**

a) What is the relation between Beta function and gamma functions and also find $\beta(5,3)$.

b) Evaluate $\int_0^1 x^4 e^{-x} dx$

c) If $f(x,y) = x^2 \cos y$ then what is the value of $\nabla^2 f$ at $(0,0)$.

d) What is the value of $L[\mathrm{g}(t)]$ where $g(t) = \begin{cases} 0, & t \le \frac{1}{2} \\ t + \frac{3}{2}, & t > \frac{1}{2} \end{cases}$

e) Using Convolution, find the value of $L^{-1}\left[\frac{1}{s^2(s^2+1)}\right]$.

f) Evaluate $L[t^2 \cos t]$.

g) Find the Directional derivative of the function f = $e^x + e^y$ at a point p (0,0) in the direction of the vector $\vec{a} = 2\hat{\imath} - 4\hat{\jmath}$.

h) The value of $\int_C F(r) \cdot dr, where\, F = [y^2, -x^2]$ and C: Be the line segment from (0, 0) to (4, 4).

i) Find a parametric representation of the equation of sphere $x^2 + y^2 + z^2 = 1$.

j) Find the coefficient of $\sin nx$ in the Fourier series expansion of $f(x) = x^2$ $(0 < x < 2\pi)$

Part – B (Answer any four questions)

Q3 a) Solve the following integral equation using Laplace transformation $y(t) = \sin 2t + \int_0^t \sin 2(t-u) y(u) du$ **(10)**

b) Show that $\Gamma(n+1) = n!$ where n is a positive integer. **(5)**

Q4 a) Solve the following initial value problem using Laplace transformation **(10)**
$\frac{d^2y}{dt^2} - 8\frac{dy}{dt} + 15y = 9te^{2t}\; with\; y(0) = 5, y'(0) = 10$

b) Show that $L\left[\frac{\cos at}{t}\right]$ does not exist. **(5)**

Q5 a) Evaluate the Surface integral $\iint_S F \cdot n\, dA$ by Gauss divergence theorem where, $F = [\cos y, \sin x, \cos z], s$ is the surface of $x^2 + y^2 \le 4, |z| \le 2$. **(10)**

b) Evaluate $\int_C F \cdot dr$ where $F = (x^2 + y^2)i + xyj$ and C be the arc of the curve $y = x^3$ from $(0,0)\; to\; (3,9)$. **(5)**

Q6 a) Find the polar moment of inertia about the origin of the mass of the density $f(x, y) = 2018$ in the region : $0 \le y \le 1 - x^2, 0 \le x \le 2$. **(10)**

b) Find the coordinates of the center of gravity of a mass of density f$(x, y) = 1$ in the region R :the triangle with vertices $(0,0), (b, 0)\; and\; (b, h)$. **(5)**

Q7 a) Find the Fourier series expansion of $f(x) = \begin{cases} x & if\; 0 < x < 1 \\ 1 - x & if\; 1 < x < 2 \end{cases}$ with period P = 2. **(10)**

b) Find the Fourier Transformation of $(x) = \begin{cases} e^x & ;\; x < 0 \\ e^{-x} & ;\; x > 0 \end{cases}$. **(5)**

Q8 a) Verify Stokes Theorem, when F= $y\hat{\imath} + (x - 2xz)\hat{\jmath} - xy\hat{k}$ and surface 'S' is the part of the sphere $x^2 + y^2 + z^2 = 4$ above the xy plane. **(10)**

b) Find the coordinates of the center of gravity of a mass of density f$(x, y) = 1$ in the region R : $x^2 + y^2 \le 1$ in the first octant. **(5)**

Q9 a) Prove that the Fourier integral $\int_0^\infty \frac{\cos \omega x}{1+\omega^2} d\omega = \frac{\pi}{2} e^{-x}\; for\; x > 0$ **(10)**

b) Using Gamma function evaluate $\int_0^\infty x^6 e^{-3x} dx$. **(5)**

Registration No :

Total Number of Pages : 02

B.Tech

PAT2A001

2nd Semester Back Examination 2018-19

APPLIED MATHEMATICS - II

BRANCH : AEIE, AERO, AUTO, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, IEE, IT, MANUTECH, MECH, METTA, MINERAL, MINING, MME, PE, PLASTIC, PT, TEXTILE

Max Marks : 100

Time : 3 Hours

Q.CODE : F127

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part- I

Q1 Only Short Answer Type Questions (Answer All-10) (2 x 10)

a) Using definition of Laplace transformation, determine $L\{e^{at}\}$, when $s > a$.

b) Find $L\{e^{at}t^n\}$.

c) The function $f(x) = cos(x)$ is even function or odd function or neither even nor odd. Justify your answer.

d) Write the Fourier series of $f(x)$ in the interval $(-\pi, \pi)$.

e) Write the relation between beta and gamma function.

f) If $\vec{r} = x^2\hat{\imath} + y^2\hat{\jmath} + z\hat{k}$, then find $div(\vec{r})$.

g) Check whether the vector $\vec{v} = yz\hat{\imath} + zx\hat{\jmath} + xy\hat{k}$ is irrotational or not.

s Find directional derivative of $f = sin\, yz + xyz$ at $P:(-1,1,3)$ in the direction $\vec{a} = \hat{\imath} - 2\hat{\jmath} + 2\hat{k}$.

i) State Stokes's Theorem.

j) Determine values of a_0 and a_n in the Fourier expansion of $f(x) = sinx, -\pi < x < \pi$.

Part- II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

a) Develop Laplace transform of the piecewise continuous function

$$f(t) = \begin{cases} t, & 0 \le t < 1 \\ 2-t, & 1 \le t < 2 \\ 0, & t \ge 2 \end{cases}$$

b) Calculate $L\{\int_0^t \int_0^t \int_0^t cosau\, du\, du\, du\}$.

c) Solve the integral equation $y(t) = t + \int_0^t y(u) sin(t-u) du$.

d) Calculate Fourier Cosine transform and Fourier Sine transformation of

$$f(x) = \begin{cases} 1, 0 \le x < 1 \\ 0, \quad x \ge 1 \end{cases}$$

e) Develop Fourier series for $f(x) = |x|, -2 < x < 2, p = 4$.

f) Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.

g) Calculate $\int_0^{\frac{\pi}{2}} \frac{\sqrt[3]{sin^8(x)}}{\sqrt{cos(x)}} dx$.

h) For any scalar function f(x,y,z) and vector function $\vec{v} = [v_1, v_2, v_3]$, Prove that

i. $Curl(grad\, f) = 0$

ii. $Div(curl\, \vec{v}) = 0$

i) Calculate length of the curve $\vec{r}(t) = a\cos t\,\hat{\imath} + a\sin t\,\hat{\jmath} + 4t\,\hat{k}$ from $(a,0,0)$ to $(a,0,8\pi)$.

j) Use Green's theorem to evaluate the line integral $\oint_c -y^3dx + x^3dy$ where c is the circle $x^2 + y^2 = 1$.

k) Develop Half range Fourier Cosine series of the function $f(x) = x^2, 0 < x < 2$.

l) Calculate the work done in moving a particle in the force field $\vec{F} = 3x^2\hat{\imath} + (2xz - y)\hat{\jmath} + z\,\hat{k}$ along a straight line from $A(0,0,0)$ to $B(2,1,3)$.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Verify Green's theorem in plane for $\oint_c (x^2 - 2xy)dx + (x^2y + 3)dy$ where c is the boundary of the region defined by $y^2 = 8x$ and $x = 2$ **(16)**

Q4 Use convolution theorem to evaluate $L^{-1}\{\frac{1}{s^2(s^2+1)}\}$. **(16)**

Q5 Solve using Laplace transform technique **(16)**

$$y'' + 4y = 9t, \qquad y(0) = 0,\ y'(0) = 7$$

Q6 a) Using Fourier integral representation, show that **(10)**

$$\int_0^\infty \frac{\cos x\omega + \omega\sin x\omega}{1 + \omega^2}d\omega = \begin{cases} 0, & if\ x < 0 \\ \frac{\pi}{2}, & if\ x = 0 \\ \pi e^{-x}, & if\ x > 0 \end{cases}$$

b) Evaluate Fourier series of $f(x) = x^2, -\pi < x < \pi$. **(6)**

Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech.**

PAT2A001

2nd Semester Regular / Back Examination 2017-18

APPLIED MATHEMATICS - II

BRANCH : AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FAT, IEE, IT, MANUFAC, MANUTECH, MECH, METTA, MINERAL, MINING, MME, PE, PLASTIC, PT, TEXTILE

Time : 3 Hours

Max Marks : 100

Q.CODE : C602

Answer Part-A which is compulsory and any four from Part-B.

The figures in the right hand margin indicate marks.

Answer all parts of a question at a place.

<u>Part – A (Answer all the questions)</u>

Q1 **Answer the following questions:** ***multiple type or dash fill up type:*** **(2 x 10)**

a) $L^{-1}[\frac{s+3}{S^2-s-2}]$ =________?

b) The Laplace transformation $of the function\, f(t) = (5^t)$ is ________?

c) The fundamental period of f(x)= $10^{100}sin^2x + 10^{100}cos^2x$ is ________?

d) Using Gamma function finds the value of $\int_0^\infty x^6 e^{-2x}dx$ is ___________?

e) curl (grad f) = ____________?

f) The Fourier sine transformation of the function f(x)= e^{-ax}(a>0) is ________?

g) The value of $\int_C F(r)\cdot dr, where\ F = [y^2, -x^2]$ and C: Be the line segment from (0, 0) to (1, 4) is __________?

h) The value of integral $\int_0^1 x^4(1-x)^2dx$ is _______

i) The value of t $* \, sint$ is __________?

j) The value of the constant 'b' such that f$(x, y, z) = [bx^2y + yz,\ xy^2 - xz^2,$ $2xyz - 2x^2y^2]$ has divergence zero is _____________?

Q2 **Answer the following questions:** ***Short answer type:*** **(2 x 10)**

a) Find the Laplace transformation of the function f$(t) = cosh\ at\ sinh\ bt$

b) Find $\nabla^2 f\ \ where\ \ f = e^{2x}sin2y.$

c) Write the sufficient condition for existence of Laplace transformation of a function.

d) Find the Directional derivative of the function f = $x^2 + y^2$ at a point p $(1,1)$ in the direction $\vec{a} = 2\hat{\imath} - 4\hat{\jmath}$

e) State Green's theorem in plane.

f) Find the Laplace transformation of the unit impulse function $\delta(t - 2^{2017})\ and$ The unit step function $U(t - 2^{2017})$

g) Find the Fourier sine series of the function f(x)= $-100^{10}(-\pi < x < \pi)$; f(x)= $100^{10}(0 < x < \pi)$

h) Find a parametric representation of the Parabolic equation $z = 9(x^2 + y^2)$

i) Find L[f(t)], Where $f(t) = \begin{cases} 1; 0 < t < 1 \\ 2; 2 < t < 4 \\ 0; \quad\ \ t > 4 \end{cases}$

j) Find the value of $L^{-1}\left[\frac{s^2+6}{(s^2+1)(s+4)}\right]$

Part – B (Answer any four questions)

Q3 **a)** Solve the following initial value problem using Laplace transformation **(10)**
$\frac{d^2y}{dt^2}+4\frac{dy}{dt}+8y=\cos 2t \; with \; y(0)=2, y'(0)=1$

b) Show that L$\left(\frac{\cos\sqrt{t}}{\sqrt{t}}\right)=\sqrt{\frac{\pi}{s}}e^{(-1/4s)}$ **(5)**

Q4 **a)** Verify Green's Theorem in the plane for $\oint_C (xy+y^2)dx+x^2dy$, where 'C' is the closed curve of the region bounded by y= $x^2 \; and \; y=x$ **(10)**

b) Find the area bounded by one arch of the cycloid x= $a(\theta-\sin\theta), y=a(1-\cos\theta)$; 0≤ $\theta\le 2\pi$ **(5)**

Q5 **a)** Prove that the integral $\int_0^\infty \frac{\sin\omega\cos\omega x}{\omega}d\omega=\begin{cases}\frac{\pi}{2}\,; 0\le x<1\\ \frac{\pi}{4}\,; \quad x=1\\ 0\,; \quad x>1\end{cases}$ **(10)**

b) Prove that $\Gamma(-\frac{7}{2})=\frac{2^4\sqrt{\pi}}{105}$ **(5)**

Q6 **a)** Solve the following integral equation using Laplace transformation **(10)**
$y(t)=1+\int_0^t\cos(t-u)y(u)du$

b) Using convolution prove that **(5)**
2$* \, 2 * 2 * \cdots\cdots\cdots * 2(upto \; 'K' \; times)=\frac{2^K t^{K-1}}{(K-1)!}$

Q7 **a)** Verify Stokes Theorem, when F= $y\hat{\imath}+(x-2xz)\hat{\jmath}-xy\hat{k}$ and surface 'S' Is the part of the sphere $x^2+y^2+z^2=a^2$ above the x-y plane. **(10)**

b) Find the total Mass of a mass distribution of density f$(x,y,z)=e^{-x-y-z}$ in a region T: 0≤ $x\le 1-y, 0\le y\le 1, 0\le z\le 2$ **(5)**

Q8 **a)** Verify Divergence Theorem for F= $z\hat{\imath}+x\hat{\jmath}-yz\hat{k}$ taken over the surface of the cylinder $x^2+y^2=9$ included in the first octant between $z=0 \; and \; z=4$ **(10)**

b) Find the coordinates of the center of gravity of a mass of density **(5)**
f$(x,y)=1$ in the region R : the triangle with vertices $(0,0),(b,0) \; and \; \left(\frac{b}{2},h\right)$

Q9 **a)** Find the Fourier Transformation of $f(x)=\begin{cases}0\;, & x<0\\ e^{-x^2}, & x>0\end{cases}$ **(10)**

b) Find the Fourier series expansion of $f(x)=\begin{cases}\frac{1+2x}{2} & if \; -\frac{1}{2}<x<0\\ \frac{1-2x}{2} & if \quad 0<x<\frac{1}{2}\end{cases}$ **(5)**