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FIRST Mid Term Examination, 2016 – 2017
B. Tech. I Year I Semester
AHM – 1101: Engineering Mathematics - I

Time: - 1 ½ Hrs. **Max. Marks:- 20**

SECTION A (1 x 5 = 5 marks)

Note : Attempt **ALL** questions.

Q.1. Calculate the Jacobian $J\left(\frac{u,v,w}{x,y,z}\right)$ of the following:

$u = x + 2y + z,\ v = x + 2y + 3z,\ w = 2x + 3y + 5z$

Q.2. If $w = (y-z)(z-x)(x-y)$ then find $\frac{\partial w}{\partial x}+\frac{\partial w}{\partial y}+\frac{\partial w}{\partial z}$

Q.3. Find the degree of the homogeneous function

$u(x, y, z) = \frac{xy+yz+zx}{x^2+y^2+z^2}$

Q.4. Find the asymptotes parallel to x – axis for the curve

$x^2y^2 = a^2(x^2+y^2)$; a is a constant.

Q.5. Given curve is :

$$(a+x)y^2 = x^2(3a-x)$$

(i) About which of the coordinate axes, the above curve is symmetrical?
(ii) What are its tangents at the origin?

SECTION B (2 x 3 = 6 marks)

Note : Attempt any **THREE** questions.

Q.1. If $u = e^{xyz}$, prove that $\frac{\partial^3 u}{\partial x\partial y\partial z} = (1+3xyz+x^2y^2z^2)u$

Q.2. If $u=\frac{yz}{x}, v=\frac{zx}{y}, w=\frac{xy}{z}$ then show that $J\left(\frac{u,v,w}{x,y,z}\right) = 4$

Q.3. If $V = \frac{x^4 y^4}{x^4 + y^4}$ then using Euler's theorem, prove that:

$$x\frac{\partial V}{\partial x} + y\frac{\partial V}{\partial y} = 4V.$$

Q.4. Expand $F(x, y) = e^x \cos y$ at $(1, \frac{\pi}{4})$.

SECTION C (3 x 3 = 9 marks)

Note : Attempt any **THREE** questions.

Q.1. If $u = \log\left[\frac{x^5 + y^5}{x^2 + y^2}\right]$ then using Euler's theorem, find $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$

Q.2. If $u = \frac{x+y}{1-xy}, v = \tan^{-1} x + \tan^{-1} y$ then find $J\left(\frac{u, v}{x, y}\right)$. Are u and v, functionally related? If yes, find the relationship between them.

Q.3. If u = f (y − z, z − x , x − y), prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$.

Q.4. A wire of length b is cut into two parts which are bent in the form of a square and a circle respectively. Find the least value of the sum of the areas so found using Lagrange's method of multipliers.

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First Term Examination, 2017-18

Course: B.Tech **Year: I** **Semester: I**

Engineering Mathematics I (AHM- 1201)

Time: 1 Hr. **Total Marks: 15**

Note: Attempt ALL questions.

Section A (2x3=6)

Q.1 Expand $e^x \sin y$ in powers of x and y as far as the terms of third degree.

Q.2 Find the asymptotes of the $y^3 - x^2y + 2y^2 + 4y + 1 = 0$.

Q.3 Given the curve: $\frac{y^2}{x^2} = \frac{(3a-x)}{(a+x)}$

(i) Check the symmetry of the above curve about both the axes.

(ii) Find the point of intersection of the above curve with coordinate axes.

Section B (3x3=9)

Q.1 (i) If $u = \frac{x+y}{x-y}$ *and* $v = \frac{xy}{(x-y)^2}$ then show that u and v are not independent. Also find the relation between them.

(ii) If $u = \frac{yz}{x}, v = \frac{zx}{y}, w = \frac{xy}{z}$ then calculate Jacobian of u, v and w with respect to x, y and z.

Q.2 (i) If $u = x^4 \log \frac{\sqrt[3]{y} - \sqrt[3]{x}}{\sqrt[3]{y} + \sqrt[3]{x}}$ then find $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$

(ii) If $u = F\left(\frac{y-x}{yx}, \frac{z-x}{zx}\right)$ then show that:

$$x^2\frac{\partial u}{\partial x} + y^2\frac{\partial u}{\partial y} + z^2\frac{\partial u}{\partial z} = 0$$

Q.3 A sheet of poster has its area 18 m^2. The margin at the top and bottom are 75 cm and at the sides 50 cm. What are the dimensions of the poster if the area of the printed space is maximum.

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FIRST Term Odd Semester Examination, 2018-19

B.Tech. (I Year) – Semester – I

Subject: - Engineering Mathematics I (BMAS 0101)

Time: 1 Hour **Max. Marks: 15**

Section-A

Note: ***Attempt ALL Questions.*** **(2×3=6 marks)**

Q.1 (a) If $u(x,y) = \sin^{-1}\dfrac{x}{y} + \tan^{-1}\dfrac{y}{x}$, Using Euler's theorem, prove that

$$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 0$$

(b) Find the asymptotes' parallel to the axes for the curve $x^2y^2 = a^2(x^2 + y^2)$

Q.2 Expand $e^x \cos y$ in powers of x and y as far as terms of third degree.

Q.3. (a) If $x^y + y^x = c$, find $\dfrac{dy}{dx}$ using partial derivatives.

(b) Discuss the nature of double points at origin to the curve $y^2(a+x) = x^2(3a-x)$.

Section–B

Note: ***Attempt ALL Questions.*** **(3 × 3 = 9 marks)**

Q.1. The pressure P at any point (x, y, z) in space is $P = 400xyz^2$. Find the highest pressure at the surface of a unit sphere $x^2 + y^2 + z^2 = 1$

Q.2. If $u = x + y + z$, $v = x - y + z$ and $w = x^2 + y^2 + z^2 - 2yz$, prove that u, v, w are not Independent .Also Find the relation between them.

Q.3 If $x^x y^y z^z = a$ Show that at x = y = z, $\dfrac{\partial^2 z}{\partial x \partial y} = -(x \log ex)^{-1}$; 'a' is a constant.

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Mid Term Examination, 2019 – 20
B. Tech. I Year I Semester

Sub.: Engineering Mathematics I (BMAS 0101)

Time: 2 Hrs. **Note:** Attempt **ALL** sections. **Total Marks: 30**

SECTION A **(2 x 3 = 6 marks)**

Instructions: This section has **3** questions. Attempt **ALL** questions. The symbols have their usual meanings.

Q.1. If $f(x,y,z) = \begin{vmatrix} x^2 & y^2 & z^2 \\ x & y & z \\ 1 & 1 & 1 \end{vmatrix}$,

find $\frac{\partial f}{\partial x} + \frac{\partial f}{\partial y} + \frac{\partial f}{\partial z}$.

Q.2. Determine the functional relationship between two functions:

$$u = \frac{x}{y}, \quad v = \frac{x+y}{x-y},$$

given that the Jacobian $\frac{\partial(u,v)}{\partial(x,y)} = 0$ and also $x \neq y$.

Q.3. If $V(x,y) = \frac{x^3y^3}{x^3+y^3}$, using Euler's theorem, evaluate:

$$x\frac{\partial V}{\partial x} + y\frac{\partial V}{\partial y}.$$

SECTION B (3 x 3 = 9 marks)

Instructions: This section has **3** questions. Attempt **ALL** questions. The symbols have their usual meanings.

Q.1. If
$$x = u + v + w,$$
$$y = vw + wu + uv, \text{ and}$$
$$z = uvw,$$

and F is a function of x, y and z, show that,

$$u\frac{\partial F}{\partial u} + v\frac{\partial F}{\partial v} + w\frac{\partial F}{\partial w} = x\frac{\partial F}{\partial x} + 2y\frac{\partial F}{\partial y} + 3z\frac{\partial F}{\partial z}.$$

Q.2. Expand the function

$$f(x, y) = x^2 y + \sin y + e^x$$

in powers of $(x - 1)$ and $(y - \pi)$ up to second degree terms.

Q.3. Find the rank of the matrix A by reducing to Echelon form if:

$$A = \begin{bmatrix} -2 & -1 & 3 & -1 \\ 1 & 2 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$$

SECTION C (3 x 5 = 15 marks)

Instructions: This section has 4 questions. Attempt **ANY THREE** questions. The symbols have their usual meanings.

Q.1. Test the consistency for the following system of linear equations and if system is consistent, solve for x, y and z:

$$x + y + z = 6,$$

$$x + 2y + 3z = 14,$$

$$x + 4y + 7z = 30.$$

Q.2. If $u^3 + v^3 + w^3 = x + y + z,$

$$u^2 + v^2 + w^2 = x^3 + y^3 + z^3, \text{ and}$$

$$u + v + w = x^2 + y^2 + z^2,$$

then find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$.

Q.3. Find the maximum and minimum distances of the point (3, 4, 12) from the sphere $x^2 + y^2 + z^2 = 1$, using Lagrange's method of undetermined multipliers.

Q.4. If $\quad log_e u = \frac{x^3+y^3}{3x+4y}$, Use Euler's theorem to prove that:

$$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2u\ log_e u,$$

Hence also evaluate,

$$x^2\frac{\partial^2 u}{\partial x^2} + y^2\frac{\partial^2 u}{\partial y^2} + 2xy\frac{\partial^2 u}{\partial x \partial y}.$$

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Mid-Term Examination, Odd Semester 2021-22

B. Tech. I Year, I Semester

Subject Code: BMAS 1101 **Subject Name: Engineering Mathematics I**

Time: 02 Hours **Maximum Marks: 30**

Section- A

Note: Attempt ALL THREE Questions. 3 x 2 = 6 Marks

1. Test the convergence of the following infinite series:

$$\sqrt{\frac{1}{4}} + \sqrt{\frac{2}{7}} + \sqrt{\frac{3}{10}} + \sqrt{\frac{4}{13}} + \cdots$$

2. Write n^{th} term of the following infinite series:

$$\frac{1}{2.3} + \frac{5}{3.4} + \frac{9}{4.5} + \frac{13}{5.6} + \cdots$$

3. If $u = x^2y + y^2z + z^2x$ then show that:

$$\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = (x + y + z)^2$$

Section- B

Note: Attempt ALL THREE Questions. $3 \times 3 = 9$ Marks

1. State Leibnitz's test. Test the following infinite series for its convergence:

$$1 - \frac{1}{2\sqrt{2}} + \frac{1}{3\sqrt{3}} - \frac{1}{4\sqrt{4}} + \cdots$$

2. If $u = \frac{x+y}{x-y}$ and $v = \frac{xy}{(x-y)^2}$,

then find $\frac{\partial(u,v)}{\partial(x,y)}$. Are u and v functionally dependent?

If so, find the relationship.

OR,

What is p – test? Test the convergence of the series: $\sum_{1}^{\infty} \frac{n^p}{(n+1)^q}$

3. If $u = f(P, Q, R)$ where,

$$P\,(x, y, z) = 2x - 3y,$$
$$Q\,(x, y, z) = 3y - 4z,$$
$$R\,(x, y, z) = 4z - 2x$$

Then, prove that:

$$\frac{1}{2}\frac{\partial u}{\partial x} + \frac{1}{3}\frac{\partial u}{\partial y} + \frac{1}{4}\frac{\partial u}{\partial z} = 0.$$

Section- C

Note: Attempt ANY THREE Questions. 3 x 5 = 15 Marks

1. Test the convergence or divergence of the following infinite series:

(a) $1 + \frac{x}{2} + \frac{x^2}{5} + \frac{x^3}{10} + \frac{x^4}{17} + \cdots$

(b) $\sum_{n=1}^{\infty} \left(1 + \frac{1}{n}\right)^{n^2}$

2. Given that:

$$z = x^n f_1\left(\frac{y}{x}\right) + y^{-n} f_1\left(\frac{x}{y}\right),$$

Then prove that:

$$\left(x^2 \frac{\partial^2 z}{\partial x^2} + y^2 \frac{\partial^2 z}{\partial y^2} + 2xy \frac{\partial^2 z}{\partial x \partial y}\right) + \left(x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y}\right) = n^2 z$$

3. (a) If $u(x, y, z) = x^3 + y^3 + z^3 + 3xyz$ show that,

$$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z} = 3u$$

(b) If $y_1 = \frac{x_2 x_3}{x_1}$, $y_2 = \frac{x_1 x_3}{x_2}$, $y_3 = \frac{x_2 x_1}{x_3}$, then find

$$J\left(\frac{y_1, y_2, y_3}{x_1, x_2, x_3}\right).$$

4. If $u = \sec^{-1}\left(\frac{x^3-y^3}{x+y}\right)$, then by using Euler's theorem, prove that

(a) $$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2\cot u.$$

(b) $$x^2\frac{\partial^2 u}{\partial x^2} + y^2\frac{\partial^2 u}{\partial y^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} = -2\cot u\,(1 + 2\,cosec^2 u).$$

Course Name: **Engineering Calculus**

Course Outcomes

CO1- Compute n^{th} order derivative and study its application in Leibnitz theorem

CO2- Understand partial differentiation and its applications

CO3- Evaluate double and triple integrals and study their applications

CO4- Learn the use of change of variables in solving multiple integrals

CO5- Find the gradient of a scalar field and divergence, curl of a vector field

CO6- Know various integral theorems related to line, surface and volume integrals

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Mid Term Examination, Odd Semester 2022-23

B. Tech. (All sections), First Year, First Semester

Subject Code & Subject Name- BMAS 0104 & ENGINEERING CALCULUS

Time: 2 Hours **Maximum Marks: 30**

Instructions for students:

1. *Attempt all questions.*
2. *Answers should be brief and lucid.*

Section – A

Attempt All Questions. 3 X 5 = 15 Marks

No.	Detail of Question	Marks	CO	BL	KL
1	Write down the n^{th} derivative of the following functions: $(i)\ y = \sin 2x$ $(ii)\ y = \log_e x$ $(iii)\ y = e^{3x}$	1 + 1 + 1	1	U	P
2	If $z = \log_e (x^2 + xy + y^2)$ then prove that: $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = 2$	3	2	A	F

3	If $$V = \frac{x^4 y^4}{x^4 + y^4}$$ then using Euler's theorem, prove that: $$(i)\ x\frac{\partial V}{\partial x} + y\frac{\partial V}{\partial y} = 4V$$ $$(ii)\ x^2\frac{\partial^2 V}{\partial x^2} + 2xy\frac{\partial^2 V}{\partial x\,\partial y} + y^2\frac{\partial^2 V}{\partial y^2} = 12V$$	3	2	A	C
4	Expand $f(x,y) = e^x \sin y$ in powers of x and y as far as the terms of the third degree.	3	2	A	P
5	If $$y_1 = \frac{x_2 x_3}{x_1}, y_2 = \frac{x_1 x_3}{x_2}, y_3 = \frac{x_1 x_2}{x_3}$$ then show that: $$\frac{\partial(y_1, y_2, y_3)}{\partial(x_1, x_2, x_3)} = 4.$$	3	2	U	F

Section – B

Attempt All Questions 5 X 3 = 15 Marks

No.	Detail of Question	Marks	CO	BL	KL
6	Prove that: $$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = 2\tan u$$ if, $$u = sin^{-1}\left(\frac{x^3 + y^3 + z^3}{ax + by + cz}\right)$$	5	2	An	M

7	If $w = f(x,y)$ where, $x = e^{u}\cos v$ and $y = e^{u}\sin v$ then, show that, $$y\frac{\partial w}{\partial u} + x\frac{\partial w}{\partial v} = e^{2u}\frac{\partial w}{\partial y}$$ **OR,** If $$u^3 + v^3 = x + y, \quad u^2 + v^2 = x^3 + y^3$$ then evaluate: $$\frac{\partial(u,v)}{\partial(x,y)}$$	5	2	A	P
8	Using Lagrange's method of undetermined multipliers, show that the rectangular solid of maximum volume that can be inscribed in a given sphere is a cube. **OR,** If $y = \sin\ (m\ sin^{-1}x)$, then prove that $(i)\ (1-x^2)y_2 - xy_1 + m^2y = 0$ $(ii)\ (1-x^2)y_{n+2} - (2n+1)\,x\,y_{n+1} = (n^2 - m^2)y_n$ Here, m is a constant.	5	2	C	M

CO – Course Outcome, BL – Abbreviation for Bloom's Taxonomy Level (R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, C-Create), KL – Abbreviation for Knowledge Level (F-Factual, C-Conceptual, P-Procedural, M-Metacognitive).

Course Name: Matrices, Differential Equations and Laplace Transform

Course Outcome

- CO1- Know the rank of a matrix and its applications in solving systems of linear equations
- CO2- Find the Eigen values and Eigen vectors of a square matrix
- CO3- Solve linear ordinary and partial differential equations of higher orders
- CO4- Classify the linear partial differential equations as elliptic, parabolic, and hyperbolic
- CO5- Apply Laplace transform to Engineering problems using properties
- CO6- Apply Inverse Laplace transform to Engineering problems

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Mid Term Examination, Even Semester 2022-23

B.Tech. Year - I, Semester - II

BMAS 1105: Matrices, Differential Equations and Laplace transform

Time: 2 Hours **Maximum Marks: 30**

Section – A

Attempt All Questions. 3 X 5 = 15 Marks

No.	Detail of Question	Marks	CO	BL	KL
1	Obtain the complete solution of the following linear differential equation : $$(D^2 - 2D + 1)^2\, y = 0,$$ where, $D \equiv \frac{d}{dx}$ OR, Explore the complete solution of the second order linear differential equation, $$\frac{d^2y}{dx^2} - y = 1$$ which vanishes when $x = 0$ and tends to a finite limit as $x \to -\infty$.	3	3	E	C

2	Reduce the following matrix A into either normal form or echelon form. $$A = \begin{bmatrix} 1 & -2 & 3 & -1 \\ 2 & -1 & 2 & 2 \\ 3 & 1 & 2 & 3 \\ -2 & 4 & -6 & 2 \end{bmatrix}$$ hence find the rank of matrix A. What will happen to the rank of matrix A if all the elements of matrix A are taken as 1?	3	1	An	P
3	Show that the following system of equations: $$x + 2y = 2u,$$ $$2x - y - u = 0,$$ $$x + 2z - u = 0,$$ $$4x - y + 3z - u = 0$$ do not have a non-trivial solution.	3	1	A	C
4	Solve the following differential equations of first order and first degree: (i) $\frac{dy}{dx} = \frac{x^2 - 4y}{4x - y^2}$ (ii) $(e^y + 1)\cos x\, dx + e^y \sin x\, dy = 0$	3	3	U	F

5	Define complex matrix and give an example of complex matrix of order 3 x 3. Show that the matrix A where, $$A = \begin{bmatrix} 2 & 3-4i \\ 3+4i & 2 \end{bmatrix}$$ is Hermitian. Also verify if iA is Skew-Hermitian matrix?	3	1	R	C

Section – B

Attempt All Questions. 5 x 3 = 15 Marks

No.	Detail of Question	Marks	CO	BL	KL
6	Find the eigen values and eigen vectors of the matrix $$A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$$ Also, without finding A^{-1}, find the eigen values of A^{-1}.	5	2	E	C
7	Solve the following differential equations: (i) $(y - x y^2)\, dx - (x + x y^2)\, dy = 0$ (ii) $\frac{d^4y}{dx^4} - y = e^x$ **OR,** Check the consistency of the following system of simultaneous linear equations and hence solve, if consistent. $$\begin{aligned} -x + y + 2z &= 2, \\ 3x - y + z &= 6, \\ -x + 3y + 4z &= 4 \end{aligned}$$ Also, if the constants of the right-hand side (R.H.S.) of each of the above equations are made zero, will the new system have a unique trivial solution or an infinite number of non-trivial solutions? Give reasons.	5	3	An	P

8	Obtain the complete solution of the following differential equations: $$(i)\ (D^2 + 16 - 8D)\, y = e^{4x} - e^{-4x} + 3$$ $$(ii)\ y\,dx - x\,dy + \log x\ dx = 0$$ OR, (i) Find the characteristic equation of the matrix $$A = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$$ Hence find the real latent roots of A. (ii) Show that $A = \frac{1}{\sqrt{3}}\begin{pmatrix} 1 & 1 & 1 \\ 1 & \omega & \omega^2 \\ 1 & \omega^2 & \omega \end{pmatrix}$ is a unitary matrix where ω is a complex cube root of unity. It is known that $\omega^3 = 1$ and $1 + \omega + \omega^2 = 0$.	5	3, 2	C	M

CO – Course Outcome, BL – Abbreviation for Bloom's Taxonomy Level (R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, C-Create), KL – Abbreviation for Knowledge Level (F-Factual, C-Conceptual, P-Procedural, M-Metacognitive).