

COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

B.TECH. DEGREE I SEMESTER REGULAR/SUPPLEMENTARY EXAMINATION IN MARINE ENGINEERING MAY 2021

19-208-0101 ENGINEERING MATHEMATICS I (2019 Scheme)

Time: 30 Minutes [for Answering and Scanning/Uploading the page of the Answer Sheet]

Max. Marks: 9

INSTRUCTIONS

1. You have to be available in Google Meet Video Camera throughout the examination hours.
2. Those students who are not present through Google Meet Video Camera will not be permitted to write the online examination.
3. You have to share your '**live location**' to the faculty before uploading the answer sheet.
4. You have to answer only one question.
5. You have to write register number, subject code and module/group number (as given in the question paper) in each page.
6. Answer may not exceed one page of an A4 size paper in a standard handwriting, as far as possible.
7. If at all an answer goes beyond one page, (due to your handwriting) another page can also be used. In such a situation, the page number should be given as 1/2, 2/2.
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MODULE - I

(Answer **ANY ONE** question)

- I(1). (a) Find the vertex, foci, directrix and latus rectum of the ellipse (5)

$$x^2 + y^2 - 4x - 8y - 16 = 0$$

- (b) Find the equation of the tangents from (1, 2) to the hyperbola $9x^2 - 16y^2 = 144$. (4)

OR

- I(2). (a) Find the equation of the asymptotes of the hyperbola (5)

$$x^2 - xy + 2y^2 - 5x + 7y - 8 = 0$$

- (b) Prove that the equation of the locus of intersection of two normals to the parabola $y^2 = 4ax$, which are perpendicular to each other is the curve $y^2 = a(x - 3a)$. (4)

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MODULE - II

(Answer **ANY ONE** question)

II(1). (a) Evaluate the following (4)

(i) $\lim_{x \rightarrow 0} \left(\frac{1}{\sin x} - \frac{1}{x} \right)$

(ii) $\lim_{x \rightarrow 0} \frac{xe^x - \log(1+x)}{x^2}$

(b) Find the asymptotes of the curve $x^3 + 3x^2y - 4y^3 - x + y + 3 = 0$. (5)

OR

II(2). (a) The circular disc $(x-4)^2 + y^2 \leq 4$ is revolved about the line $y=x$. Find the volume of the solid generated. (6)

(b) Evaluate $\int_0^{\frac{\pi}{4}} x^4 \sin x dx$ (3)

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MODULE - III

(Answer **ANY ONE** question)

III(1). (a) If $y = \left(x + \sqrt{1+x^2}\right)^n$ then prove that (5)

$$(1+x^2)y_{n+2} + (2n+1)xy_{n+1} + (n^2 - m^2)y = 0$$

(b) Find the n^{th} derivative of $\cos x \cos 2x \cos 3x$. (4)

OR

III(2). (a) Find the maxima and minima, if any, of $f(x, y) = x^3 y^2 (1 - x - y)$. (5)

(b) If $u = \frac{x+y}{1-xy}$ and $v = \tan^{-1} x + \tan^{-1} y$ then find $\frac{\partial(u, v)}{\partial(x, y)}$. (4)

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MODULE - IV

(Answer **ANY ONE** question)

IV(1). (a) Calculate the volume bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$. (6)

(b) Evaluate $\int_0^5 \int_0^2 x(x^2 + y^2) dx dy$. (3)

OR

IV(2). (a) Verify that $[\bar{a} + \bar{b}, \bar{b} + \bar{c}, \bar{c} + \bar{a}] = 2[\bar{a}, \bar{b}, \bar{c}]$ for $\bar{a} = 2\hat{i} + \hat{j} + \hat{k}$, $\bar{b} = \hat{i} + \hat{j} - \hat{k}$, $\bar{c} = \hat{i} + \hat{j} + 2\hat{k}$. (5)

(b) Verify that $\bar{a} \times (\bar{b} + \bar{c}) + \bar{b} \times (\bar{c} + \bar{a}) + \bar{c} \times (\bar{a} + \bar{b}) = 0$ for $\bar{a} = 2\hat{i} + \hat{j} + 2\hat{k}$, $\bar{b} = \hat{i} + 2\hat{j} - \hat{k}$, $\bar{c} = \hat{i} - \hat{j} + \hat{k}$. (4)

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MODULE - V

(Answer **ANY ONE** question)

V(1). (a) Show that the vector point function $\vec{F} = \text{Grad}(x^3 + y^3 + z^3 - 3xy)$ forms a conservative field. (5)

(b) Find the div and curl of the vector $\vec{v} = (xyz)\hat{i} + 3x^2y\hat{j} + (xz^2 - y^2z)\hat{k}$ at $(1, -1, -1)$. (4)

OR

V(2). (a) If $A = (3x^2 + 6y)\hat{i} - 14yz\hat{j} + 20xz^2\hat{k}$, evaluate $\int A \cdot dr$ from $(0,0,0)$ to $(1,1,1)$ along the path $x=t, y=t^2, z=t^3$. (5)

(b) Verify Greens theorem for $\int_C (3x - 8y^2)dx + (4y - 6xy)dy$ where C is the boundary of the region bounded by $x=0, y=0, x+y=1$. (4)
