Hall Ticket No | | | | | | | | | | | Question Paper Code: AHSC07

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.TECH II Semester End Examinations (Regular) AUGUST- 2021

Regulation:UG20

MATHEMATICAL TRANSFORM TECHNIQUES

Time: 3 Hours **(ECE|EEE|AE|ME|CE)** **Max Marks: 70**

Answer all questions in Modules I and II
Answer ONE out of two questions from Modules III, IV and V
(NOTE: Provision is given to answer TWO questions from among one of the Modules III / IV / V)
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) State convolution theorem in Laplace transforms. Write the Laplace transform of the first derivative and the second derivative. **[7M]**

   (b) Find the Laplace transform of $\frac{\cos 2t - \cos 3t}{t}$ **[7M]**

MODULE – II

2. (a) State Fourier integral theorem. Write the Fourier sine integral and cosine integral of f(x). Also state Fourier transform of f(x). **[7M]**

   (b) Find the Fourier sine and cosine transform of f(x) = e^{-ax}. **[7M]**

MODULE – III

3. (a) Evaluate the double integral $\int_0^{\pi} \int_0^{a\sin\theta} r dr d\theta$ **[7M]**

   (b) Find by triple integration, the volume of the solid bounded by the co-ordinate planes x=0,y=0,z=0 and the plane x+ y+ z =1. **[7M]**

4. (a) Determine $\int_0^2 \int_0^{\sqrt{2x-x^2}} (x^2+y^2) dy dx$ by changing into polar co-ordinates. **[7M]**

   (b) Find the volume of tetrahedron bounded by the co-ordinate planes and the plan $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ **[7M]**

MODULE – IV

5. (a) Verify Green's theorem for $\int_C (2xy - x^2)dx + (x^2+y^2)dy$ where "C" is bounded by $y=x^2$ and $y^2=x$. **[7M]**

   (b) Find the work done by the force $\vec{F} = (3x^2 - 6yz)\vec{i} + (2y + 3xz)\vec{j} + (1 - 4xyz^2)\vec{k}$ in moving particle from the point (0,0,0) to the point(1,1,1) along the curve C: x=t, $y=t^2$, $z=t^3$. **[7M]**

6. (a) Verify Stokes theorem for the function $\vec{F} = x^2\vec{i} + xy\vec{j}$ integrated round the square in the plane z=0 whose sides are along the line x=0, y=0, x=a, y=a. **[7M]**

(b) Find the directional derivative of the function xyz^2+xz at the point P(1,1,1) in the direction of the normal to the surface $3xy^2+y=z$ at (0,1,1). **[7M]**

MODULE – V

7. (a) Eliminate the arbitrary function from the surface $z = xy+ f(x^2+y^2)$ and hence, obtain the corresponding partial differential equation. **[7M]**

   (b) Solve the partial differential equation $x(y^2+z)p - y(x^2+z)q = (x^2-y^2)z$. **[7M]**

8. (a) Find the differential equation of all spheres whose centres lie on z-axis with a given radius r. **[7M]**

   (b) Solve $(p^2+q^2)y = qz$ **[7M]**

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