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Total Number of Pages : 02

B.Tech.
BS1104

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 : 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)**
- Find $L[e^{-t} \cos 2t]$.
 - Find $L[f(t)]$, Where $f(t) = \begin{cases} 4; & 0 < t < 1 \\ 5; & 2 < t < 4 \\ 6; & t > 4 \end{cases}$
 - The Fourier sine transformation of the function $f(x) = x^2$ if $0 < x < 1$ and $f(x) = 0$ if $x > 1$.
 - Find the Directional derivative of the function $f = x - y$ at a point $p(4,5)$ in the direction $\vec{a} = 2\hat{i} + \hat{j}$
 - Find the Laplace transformation of the unit impulse function $\delta(t - 1)$ and The unit step function $U(t - 5)$.
 - What is the value of $\iint_R 2 \, dx \, dy$, $R: 0 \leq x \leq 1, 0 \leq y \leq \sqrt{1 - x^2}$?
 - Find the unit normal vector of the surface $x^2 - y^2 + z^2 = 1$
 - Evaluate $L^{-1} \left[\frac{1}{(s^2+1)(s+1)} \right]$.
 - Find the value of $e^{3t} * e^{2t}$.
 - Find $\nabla^2 f$ where $f = e^{2x} \sin 2y$.
- Q2 a) Solve the following initial value problem using Laplace transformation (5)**
 $\frac{d^2 y}{dt^2} - \frac{dy}{dt} - 2y = 4x^2$ with $y(0) = 1, y'(0) = 4?$
- b) Solve the following integral equation using Laplace transformation (5)**
 $t = 1 + \int_0^t \sin(t - u)y(u)du.$
- Q3 a) 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 (b, h) .
- 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 $f(x) = \begin{cases} x & \text{if } 0 < x < 1 \\ 1 - x & \text{if } 1 < x < 2 \end{cases}$ of period (5)**
 $p = 2$.
- b) Find the Fourier series expansion of $f(x) = \begin{cases} x & \text{if } -\frac{\pi}{2} < x < \frac{\pi}{2} \\ 0 & \text{if } \frac{\pi}{2} < x < \frac{3\pi}{2} \end{cases}$ (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 $\oint_C (y \, dx - x \, dy)$, Where, 'C' is the circle $x^2 + y^2 = \frac{1}{4}$. (5)
- b) Find the area of the region in the first quadrant under the arc of the Limacon $r = 1 + 2 \cos \theta; 0 \leq \theta \leq \frac{\pi}{2}$. (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 $f(x) = 2 - x (0 < x < \pi)$.