Reg. No. :

Question Paper Code : 53556

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Second Semester
Civil Engineering
MA 6251 – MATHEMATICS – II
(Common to Mechanical Engineering (Sandwich)/Aeronautical Engineering/ Agriculture Engineering/Automobile Engineering/Biomedical Engineering/ Computer Science and Engineering/Electrical and Electronics Engineering/ Electronics and Communication Engineering/Electronics and Instrumentation Engineering/Environmental Engineering/Geoinformatics Engineering/Industrial Engineering and Management/Instrumentation and Control Engineering/ Manufacturing Engineering/Materials Science and Engineering/Mechanical Engineering/Mechanical and Automation Engineering/Mechatronics Engineering/ Medical Electronics Engineering/Petrochemical Engineering/Production Engineering/Robotics and Automation Engineering/Biotechnology/Chemical Engineering/Chemical and Electrochemical Engineering/Fashion Technology/Food Technology/Handloom and Textile Technology/Information Technology/ Petrochemical Technology/Petroleum Engineering/Pharmaceutical Technology/ Plastic Technology/Polymer Technology/Textile Chemistry/Textile Technology)
(Regulations 2013)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions.

PART – A (10×2=20 Marks)

1. Find the unit normal vector to the surface $x^2 + y^2 = z$ at $(1, -2, 5)$.

2. State Gauss divergence theorem.

3. Solve the equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$.

4. Find the particular integral of the equation $(D^2 - 9)y = e^{-3x}$.

5. Find $L\left[\frac{\sin t}{t}\right]$.

6. Evaluate $L^{-1}\left[\frac{1}{s^2+9s+13}\right]$.

7. Is the function $f(z) = z^2$ analytic ? Justify the claim.

8. If $z = i$ is the fixed point of the bilinear transformation $w = \frac{1}{z+c}$, then find 'c'.

9. Evaluate $\int_C \frac{z}{z-1} dz$, where C is $|z-1| = 1$.

10. State Cauchy's residue theorem.

PART – B **(5×16=80 Marks)**

11. a) Verify Gauss divergence theorem for $\bar{F} = x^2\bar{i} + y^2\bar{j} + z^2\bar{k}$ taken over the cube bounded by the planes x = 0, y = 0, z = 0, x = 1, y = 1 and z = 1. **(16)**

(OR)

b) i) Find the value of n such that the vector $r^n\bar{r}$ is both solenoidal and irrotational. **(8)**

ii) Evaluate the line integral $\int_C (x^2 + xy)\, dx + (x^2 + y^2)\, dy$, where C is the square formed by the lines $x = \pm 1$ and $y = \pm 1$. **(8)**

12. a) i) Solve $(D^2 - 5D + 6)\, y = e^x \cos 2x$. **(8)**

ii) Solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$ using variation of parameters. **(8)**

(OR)

b) i) Solve $(x^2D^2 - xD + 1)y = x^2$. **(8)**

ii) Solve the simultaneous equations $\frac{dx}{dt} - y = t$ and $\frac{dy}{dt} + x = t^2$. **(8)**

13. a) i) Find the Laplace transform of f(t),

where $f(t) = \begin{cases} t, & \text{for } 0 < t < a \\ 2a - t, & \text{for } a < t < 2a \end{cases}$ and $f(t + 2a) = f(t)$. (8)

ii) Using convolution find the inverse Laplace transform of $\frac{s^2}{(s^2 + a^2)(s^2 + b^2)}$. (8)

(OR)

b) i) Find Laplace transform of $f(t) = te^{-3t} \sin 3t$. (8)

ii) Using Laplace transform, solve $\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 6y = 2$, given $y(0) = y'(0) = 0$. (8)

14. a) i) Show that $v = e^{-x}(x \cos y + y \sin y)$ is harmonic function. Hence find the conjugate harmonic function for v, when $f(z) = u + iv$ is an analytic function of z. (8)

ii) Find the bilinear trasformation that map 1, i and –1 of the z-plane onto 0, 1 and ∞ of the w-plane. (8)

(OR)

b) i) An electrostatic field in the xy-plane is given by the potential function $\phi = 3x^2y - y^3$, find the stream function. (8)

ii) Find the image of $|z + 1| = 1$ under the map $w = \frac{1}{z}$. (8)

15. a) i) Obtain the Laurent's series expansion of $f(z) = \frac{z^2 - 1}{(z+2)(z+3)}$, in $2 < |z| < 3$. (8)

ii) Evaluate $\int_0^{2\pi} \frac{d\theta}{13 + 5 \sin \theta}$. (8)

(OR)

b) i) Evaluate $\int_C \frac{(z+1)\,dz}{(z^2 + 2z + 4)}$, where C is $|z + 1 + i| = 2$. (8)

ii) Evaluate, by using contour integration, $\int_0^{\infty} \frac{dx}{(1+x^2)^2}$. (8)

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