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R20 Regulation *Subject code:3B2AE*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech II Semester Regular/Supplementary Examinations, October 2022

ORDINARY DIFFERENTIAL EQUATIONS, TRANSFORMS & VECTOR CALCULUS

(EEE)

Maximum Marks: 70 Date:11.10.2022 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10x2M=20 Marks)

1 Find the integrating factor of the differential equation $x\frac{dy}{dx} - y = 2x^2$.
2 State Newton's law of cooling.
3 Find the complementary function of $(D^4 - a^4)y = 0$.
4 Solve $(D^2 - 4D - 1)y = 0$.
5 Find $L\left(\frac{cos4t\ sin2t}{t}\right)$.
6 Find $L^{-1}\left\{\frac{3(s^2-2)^2}{2s^5}\right\}$.
7 If $\bar{f}$ = (x+3y)i +(y-2z)j +(x+pz)k is solenoidal find p.
8 Find div $\bar{f}$ when $\bar{f}$= grad $(x^3 + y^3 + z^3$ -3xyz).
9 State Stokes theorem.
10 State Gauss Divergence theorem.

Part-B

Answer All the following questions. (5X10M=50Marks)

11 a) Solve $x\frac{dy}{dx} + y = x^2y^3$ (5M)

b) The temperature of a cup of coffee was92°C, when freshly poured the room temperature being24°C. In one minute, it was cooled to80°C. When will the temperature of the cup becomes65°C? (5M)

OR

12 a) Solve the differential equation $(1-y^2)dx = (\tan^{-1} y - x)dy$ (5M)

b) A bacterial culture growing exponentially increases from 100 to 400 grams in 10 hrs. How much bacteria will be present after 3 hours? (5M)

13 a) Solve $(D^2 - 1)y = x\sin x + x^2e^x$ (5M)

b) Apply the method of variation of parameters to solve $\frac{d^2y}{dx^2} + y = cosecx$ (5M)

OR

14 a) Solve $(D+2)(D-1)^2y = e^{-2x} + 2\sin hx$ (5M)

b) Apply the method of variation of parameters to solve $\frac{d^2y}{dx^2} + y = tanx$ (5M)

15 a) Using Laplace transform, evaluate $\int_0^\infty \frac{(cosat - cosbt)}{t} dt$ (5M)

b) Using convolution theorem find $L^{-1}\left\{\frac{1}{(s^2-1)(s^2+25)}\right\}$ (5M)

OR

16 Using Laplace transform solve the differential equations: (10M)

$$\frac{d^2x}{dt^2} - 2\frac{dx}{dt} + x = e^t \text{ given that } x(0) = 2, x'(0) = -1$$

17 a) If $\bar{r} = xi + yj + zk$, $|\bar{r}| = r$ then show that $grad\, r^n = nr^{n-2}\bar{r}$. (5M)

b) Show that the vector $(x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ is irrotational and find its scalar potential. (5M)

OR

18 a) Find div $\bar{f}$ where $\bar{f} = r^n\,\bar{r}$ find n if it is Solenoidal? (5M)

b) Find the directional derivative of $f = 5x^2y - 5y^2z + 2.5z^2x$ at the point (1,1,1) in the direction of the line $\frac{x-1}{2} = \frac{y-3}{-2} = z$. (5M)

19 a) If $\bar{F} = yi - xj$, evaluate $\int_c \bar{F}.\overline{dr}$ from (0,0) to (1,1) along the straight lines from (0,0) and (1,1). (5M)

b) Evaluate $\int_s \bar{F}.\bar{n}ds$ where $\bar{F} = 18zi - 12j + 3yk$ and s is the part of the surface of the plane $2x + 3y + 6z = 12$ located in the first octant. (5M)

OR

20 Verify Greens theorem in a plane $\oint(3x^2 - 8y^2)\,dx$ +(4y -6xy) dy where C is the region bounded by y = $\sqrt{x}$ and y = x^2. (10M)