SREE VIDYANIKETHAN ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to JNTUA, Ananthapuramu)

I B.Tech I Semester (SVEC-16) Regular/Supplementary Examinations December – 2018

MULTIVARIABLE CALCULUS AND DIFFERENTIAL EQUATIONS

[Civil Engineering, Electrical and Electronics Engineering, Mechanical Engineering, Electronics and Communication Engineering, Computer Science and Engineering, Electronics and Instrumentation Engineering, Information Technology, Computer Science and Systems Engineering]

Time: 3 hours **Max. Marks: 70**

Answer One Question from each Unit
All questions carry equal marks

UNIT-I

1 a) Obtain the solution of the differential equation $y\left(2x^2y + e^x\right)dx = \left(e^x + y^3\right)dy$. 7 Marks

b) If the surroundings are maintained at 30ºC and the temperature of the body cools from 80ºC to 60ºC in 12 minutes, then determine temperature of the body after 24 minutes. 7 Marks

(OR)

2 a) Determine the solution of the differential equation $x^2ydx - \left(x^3 + y^3\right)dy = 0$. 7 Marks

b) A copper ball is heated to a temperature of 80º C. Then at time t = 0 it is placed in water which is maintained at 30ºC. If at t = 3 minutes, the temperature of the ball is reduced to 50ºC , then obtain the time at which the temperature of the ball is 40ºC. 7 Marks

UNIT-II

3 a) Determine the solution of $\left(D^2 + D + 1\right)y = x^3$. 7 Marks

b) Determine the solution of $\left(D^2 + 2\right)y = e^x \cos x$. 7 Marks

(OR)

4 a) Determine the solution of $\left(D^2 + 1\right)x = t\cos t$, given $x = 0, \frac{dx}{dt} = 0$ where $t = 0$. 7 Marks

b) Determine the solution of $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = xe^x \sin x$. 7 Marks

UNIT-III

5 a) If $x = u(1 - v), y = uv$ prove that $JJ' = 1$. 7 Marks

b) Apply Taylor's theorem to expand polynomial $x^2y + 3y - 2$ in powers of $(x - 1)$ and $(y + 2)$. 7 Marks

(OR)

6 a) Identify the functions $u = x + y + z$, $v = xy + yz + zx$ and $w = x^2 + y^2 + z^2$ are functionally dependent and if so, obtain the relation between them. 7 Marks

b) Investigate the maximum and minimum values of $f = 3x^4 - 2x^3 - 6x^2 + 6x + 1$. 7 Marks

UNIT-IV

7 a) Evaluate integral $\int_0^1 \int_0^{\sqrt{1-y^2}} \left(x^2 + y^2\right) dydx$ by changing into polar co-ordinates. 7 Marks

b) Evaluate integral $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dxdydz}{\sqrt{1-x^2-y^2-z^2}}$ by changing into spherical co-ordinates. 7 Marks

(OR)

8 a) Evaluate $\int_{-1}^{1} \int_0^{z} \int_{x-z}^{x+z} (x+y+z) dxdydz$. 7 Marks

b) Evaluate $\iint_R (x+y)^2 dxdy$, where R is the parallelogram in the XY-plane with vertices $(1,0),(3,1),(2,2),(0,1)$ using the transformation $u = x + y$ and $v = x - 2y$. 7 Marks

UNIT-V

9 a) Evaluate the directional derivative of $\phi = x^2yz + 4xz^2$ at the point (1,-2,1) in the direction of the vector $2i - j - 2k$. 7 Marks

b) Evaluate $\oint_S F.ds$ where $F = 4xi - 2y^2 j + z^2 k$ and S is the surface bounded by the region $x^2 + y^2 = 4, z = 0$ and $z = 3$. 7 Marks

(OR)

10 a) If $R = xi + yj + zk$ and $r \neq 0$, then show that $div\left(r^n R\right) = (n+3)r^n$. 7 Marks

b) Verify the Gauss Divergence theorem for $F = 4xzi - y^2 j + yzk$ taken over the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0, z =1. 7 Marks

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