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KC-6031

B. E. - I (Sem. II) (All) Examination

November / December – 2012

Engineering Mathematics - II

Time : Hours] [Total Marks : **100**

Instruction :

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. - 1 (SEM. 2) (ALL)**

Name of the Subject :

☛ **ENGINEERING MATHEMATICS - 2**

☛ Subject Code No. : **6 0 3 1** ☛ Section No. (1, 2,.....) : **NIL**

Seat No. :

Student's Signature

1 Do as directed : **10**

(1) State the Trapezoidal rule for $n = 10$.

(2) Find $\frac{\partial u}{\partial x}$ for $u = \cos^{-1}\left(\frac{x}{y}\right)$.

(3) Define Jacobian transformation $J = \frac{\partial(u, v)}{\partial(x, y)}$ and inverse Jacobian transformation $J = \frac{\partial(x, y)}{\partial(u, v)}$.

(4) State Intermediate value theorem.

(5) Find the equation tangent plane and normal line to the surface.

$2xz^2 - 3xy - 4x = 7$ at $(-1, -1, 2)$.

2 Attempt any four of the following : **20**

(1) If $u = e^{xyz}$ then prove that

$$\frac{\partial^3 u}{\partial x \partial y \partial z} = \left(1 + 3xyz + x^2y^2z^2\right)e^{xyz}.$$

(2) If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x + y}\right)$ then prove that

$xu_x + xu_y = \sin u$.

(3) Find the maxima and the minima of the function $x^3 y^3 (1 - x - y)$.

(4) Expand $e^x \cos y$ in powers of x and y using Maclaurin's series up to the 3^{rd} degree term.

(5) If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$ then prove that

$\frac{1}{2}u_x + \frac{1}{3}u_y + \frac{1}{4}u_z = 0$.

3 Attempt any **four** of the following : **20**

(1) Find a root the equation $f(x) = x^3 - 3x - 5 = 0$ correct up to three decimal places using the bisection method.

(2) Find the positive root of $x^3 + 2x^2 + 10x - 20 = 0$ by Newton-Raphson method correct to three decimal places by choosing the initial guess. $x_0 = 1.2$.

(3) Solve the following system of equation using Gauss-elimination method

$x + y + z = 9$

$2x - 3y + 4z = 13$

$3x + 4y + 5z = 40$

(4) Find the root of the equation correct to three decimal places $x^3 - 4x - 9 = 0$ by using Regula-false position method.

(5) Evaluate $\int_0^1 \frac{dx}{1 + x^2}$ using Trapezoidal rule by choosing $h = 0.1$.

4 (a) Do as directed : **10**

(1) Find P.I. of $\left(D^2+5D+6\right)y=5$.

(2) Define the Cauchy's linear differential equation with variable coefficients.

(3) Give the general solution obtained by the method by the variation of parameters.

(4) Define the following terms :
(a) Regular-singular point
(b) Ordinary point.

(5) Find the general solution of $\left(D^3-4D^2+4D\right)y=0$.

(b) Attempt the following :

(1) Prove that $\frac{1}{f(D)}e^{ax}=\frac{1}{f(a)}e^{ax}$ and discuss the case when $f(a)=0$. **4**

(2) An electric circuit consists of an inductance $0.1H$, a resistance of 20 ohm and a condenser of capacitance $25\,\mu$. Find the charge q and the current I at any time t, given that at $t=0, q=0.05$ coulomb and $i=\frac{dq}{dt}=0,$ when $t=0$. **6**

5 (a) Attempt the following : **6**

(1) $\left(D^2-2D+5y\right)=\sin 3x$

(2) $\frac{d^2y}{dx^2}+4y=x\sin x$

(3) $\frac{d^4y}{dx^4}-y=e^x\cos x$

(b) Attempt any two of the following : **8**

(1) $x^2 \frac{d^2y}{dx^2} + 9x\frac{dy}{dx} + 25y = 50$

(2) $(1+x)^2 \frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 4\cos\log(1+x)$

(3) Solve $\frac{d^2y}{dx^2} + 4y = 4\sec^2 2x$ by M.V.P.

6 (a) Find the series solution of the following using Frobenius method : **10**

(1) $x^2 y'' + xy' + (x^2 - 4)y = 0$

(2) $xy'' - 3y' + xy = 0$

(b) Attempt any one of the following : **6**

(1) A beam of length L carries a transverse uniform load w per unit length. Find the equation of the deflection curve and maximum deflection when one end of the beam is clamped and the other is simply supported.

(2) Formulate a differential equation model for the LCR circuit with voltage source. Obtain its solution. Analyze the model and write the interpretations.
