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UE-6031

First Year B. E. (Sem. II) (All) Examination

April/May – 2012

Engineering Mathematics : Paper - II

Time : 3 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 :

☛ F. Y. B. E. (SEM. 1) (ALL)

Name of the Subject :

☛ ENGINEERING MATHEMATICS : PAPER - 2

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

Seat No. :

Student's Signature

Q-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 Jacibian 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 $(-1,-1,2)$.

Q-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 $x^3y^3(1 - x - y)$.
4. Expand $e^x \cos y$ in powers of x and y using Maclaurin's series up to the 3rd degree term.
5. If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$ then prove that $\frac{1}{2}u_x + \frac{1}{3}u_y + \frac{1}{4}u_z = 0$

Q-3 Attempt any four the following. **[06]**

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 $\int_0^1 e^{-x^2}dx$ using Trapezoidal rule for n=10.

Q-4 (a) **Do as Directed** **[10]**

1. Define second order non-homogenous differential equation. What will be the form of its general solution.
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 Auxiliary equation & find the auxiliary equation of $\frac{d^4y}{dx^4}-y=\cos x\cdot\cosh x$
5. Find the general solution of $(D^3+12D^2+48D+64)y=0$

b) Attempt the following

1. Define second order Homogenous differential equation with constant coefficient & state four rules to find its general solution. **[04]**
2. Formulate differential equation of LC circuit network with voltage source $E(t)=E_0 sin\omega t$ and obtain its solution and analyze it with its physical interpretation. **[06]**

Q-5 a) Attempt the following. **[06]**

1. $\{(D+2)(D-1)^2\}y=e^{-2x}+2sinhx$
2. $(D^2-4D+3)y=5$
3. $(D^2+D+1)y=cos2x$

b) Attempt any two of the following **[08]**

1. $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+y=logx\sin logx$
2. $(3x+2)^2\frac{d^2y}{dx^2}+3(3x+2)\frac{dy}{dx}-36y=3x^2+4x+1$
3. Solve $y''+9y=sec3x$ by M.V.P

Q-6 a) Find the series solution of the following using Frobenius method: **[10]**

1. $x^2y''+xy'+(x^2-4)y=0$
2. $xy''-3y'+xy=0$
3. $xy''-3y'+xy=0$

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b) Attempt any one of the following **[06]**

1. The differential equation satisfied by a beam uniformly loaded (w kg/m), with one end fixed and the second end subjected to tensile force p, is given by $EI\frac{d^2y}{dx^2} = Py - \frac{1}{2}wx^2$. Show that the elastic curve for the beam with conditions $y = \frac{dy}{dx} = 0$ at x=0 is given by

   $y = \frac{w}{Pn^2}(1 - \cosh nx) + \frac{wx^2}{2P}; n^2 = \frac{P}{EI}$

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