



RM-6031-R

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

May / June - 2010

Engineering Mathematics - II

Time : 3 Hours]

[Total Marks : 100

Instructions :

(1)

नीचे दशावेक निशानीवाणी विगतो उत्तरवही पर अवश्य लखवी. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
B. E. - 1 (Sem. 2) (All)	<input type="text"/>
Name of the Subject :	<input type="text"/>
Engineering Mathematics - 2	<input type="text"/>
Subject Code No. : <input type="text"/> 6 <input type="text"/> 0 <input type="text"/> 3 <input type="text"/> 1	Section No. (1, 2,.....) : <input type="text"/> 1&2
Student's Signature	

(2) All questions are **compulsory**.

(3) Write each section in **separate** answer books.

SECTION - I

1 (a) Do as directed :

10

(1) If $u = \log x + \log y$ then $xu_x + yu_y =$ _____.

(2) Find the equation of tangent plane to the surface $2x^2 + y^2 + 2z = 3$ at $(2, 1, -3)$.

(3) If $u = 2xy$, $v = x^2 - y^2$, $x = r \cos \theta$, $y = r \sin \theta$ find

$$\frac{\partial(u, v)}{\partial(r, \theta)}$$

(4) Write the iteration formula for Newton-Raphson method.

(5) To use both Simpson's 1/3 and 3/8 rules, the given interval should be divided into how many numbers of subintervals ?

(b) Attempt the following :

(1) If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x - y}\right)$, show that $xu_x + yu_y = \sin 2u$ **6**

and $x^2u_{xx} + 2xyu_{xy} + y^2u_{yy} = 2 \cos 3u \sin u$.

(2) Use Gauss-Seidel method to solve : **4**

$$2x + y + z = 4$$

$$x + 2y + z = 4$$

$$x + y + 2z = 4$$

2 Attempt any **four** : **16**

(1) If $u = f(x + at) + g(x - at)$ prove that $\frac{\partial^2 u}{\partial t^2} = a^2 \frac{\partial^2 u}{\partial x^2}$

(2) If $u = \sin^{-1}(x - y)$, $x = 3t$, $y = 4t^3$, show that $\frac{du}{dt} = \frac{3}{\sqrt{1 - t^2}}$.

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

$$\frac{1}{2} \frac{\partial u}{\partial x} + \frac{1}{3} \frac{\partial u}{\partial y} + \frac{1}{4} \frac{\partial u}{\partial z} = 0$$

(4) Expand $\tan^{-1} \frac{y}{x}$ about the point (1, 1)

(5) Obtain the percentage error in the area of an ellipse when an error of 1% is made in measuring the semi major and semi minor axes.

3 (a) Attempt any **one** : **4**

(1) Find the extremum value of $x^3 + y^3 - 3axy$, $a > 0$.

(2) Show that the maximum value of $u = x^p y^q z^r$ when the variables x, y, z are subject to the condition

$$ax + by + cz = p + q + r \text{ is } \left(\frac{p}{a}\right)^p + \left(\frac{q}{b}\right)^q + \left(\frac{r}{c}\right)^r.$$

(b) Find the root of any **two** : 6

- (1) $x^2 - 4x - 10 = 0$ correct to two decimal places by using Bisection method.
- (2) $x^3 - 4x - 9 = 0$ correct to two decimal places using method of false position.
- (3) $\cos x = 3x - 1$ correct to three decimal places using iteration method.
- (4) $\sin x = 1 - x$ correct to three decimal places using Newton-Raphson method.

(c) Attempt any **one** : 4

- (1) Evaluate $\int_0^1 x^3 dx$ by using (i) Trapezoidal rule
(ii) Simpson's 1/3 rule.
- (2) Using Taylor's series method solve the IVP
 $\frac{dy}{dx} = 3x + \frac{y}{2}$, $y(0) = 1$ and find $y(0.1)$.
- (3) Using Picard's method solve $\frac{dy}{dx} = 1 + xy$, $y(0) = 0$
upto 3rd approximation.

SECTION - II

4 (a) Do as directed : 10

- (1) Find P.I. of $(D^2 + 5D + 6)y = 5$
- (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 $y'' - k^2y = 0$;
 $(k \neq 0)y(0) = 1, y'(0) = 1$.

- (b) Attempt the following :
- (1) Prove that $\frac{1}{f(D)^2} \sin ax = \frac{1}{f(-a)^2} \sin ax$; $f(-a^2) \neq 0$ 4
and discuss the case when $f(-a)^2 = 0$.
- (2) An electric circuit consists of an inductance 0.1 H, a resistance of 20 ohm and a condenser of capacitance 25μ . 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) $y'' + 25y = 24 \sin t$, $y(0)=1$, $y'(0)=1$
- (2) $(D^2 + D + 1)y = e^t$
- (3) $(D^2 + D)y = 1 + \cos t$
- (b) Attempt any **two** of the following : 8
- (1) $x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} - 3y = x^2 \log x$
- (2) $x^2 y'' + xy' - 9y = 48x^5$
- (3) Solve $y'' + 9y = \operatorname{cosec} 3x$ 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) $xy'' - 3y' + xy = 0$
- (3) $x(x-1)y'' + (3x-1)y' + y = 0$
- (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.