

Roll No. ....

**BE-202****B. E. (First/Second Semester)****EXAMINATION, June, 2010****(Common for all Branches)****ENGINEERING MATHEMATICS – II****(BE – 202)***Time : Three Hours**Maximum Marks : 100**Minimum Pass Marks : 35*

**Note :** Attempt all questions. All questions carry equal marks.  
One full question should be solved at one place.

1. (a) Prove that : 10

$$x^2 = \frac{\pi^2}{3} + 4 \sum_{n=1}^{\infty} (-1)^n \frac{\cos nx}{n^2}, \quad -\pi < x < \pi$$

and hence show that :

$$\sum \frac{1}{n^2} = \frac{\pi^2}{6}$$

- (b) Applying convolution theorem find the inverse transform of  $\frac{s^2}{(s^2 + a^2)^2}$ . 10

*Or*

- (a) If  $f(x) = \pi x$ ,  $-2 < x < 0$   
 $= \pi(2 - x)$ ,  $0 < x < \pi$

show that in the interval (0, 2) :

$$f(x) = \frac{\pi}{2} - \frac{4}{\pi} \left[ \frac{\cos \pi x}{1^2} + \frac{\cos 3\pi x}{3^2} + \frac{\cos 5\pi x}{5^2} + \dots \right]$$

**P. T. O.**

- (b) Find the Laplace transform of : 10

(i)  $t^2 \cos at$

(ii)  $(\cos at - \cos bt)/t$

2. (a) Obtain the series solution of the equation : 10

$$4x \frac{d^2 y}{dx^2} + 2(1-x) \frac{dy}{dx} - y = 0$$

- (b) Solve by the method of variation of parameters : 10

$$(D^2 + 1)y = x \sin x$$

*Or*

- (a) Prove that : 10

$$P_n(x) = \frac{1}{2^n} \left[ \frac{d^n}{dx^n} (x^2 - 1)^n \right]$$

- (b) Solve : 10

$$\frac{d^2 y}{dx^2} - 2 \tan x \frac{dy}{dx} + 5y = e^x \sec x$$

3. (a) Solve : 10

$$(x^2 - y^2 - z^2)p + 2xyq = 2xz$$

- (b) Solve : 10

$$\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} = \sin x \cos 2y$$

*Or*

- (a) Solve : 10

$$z = px + qy + \sqrt{(1 + p^2 + q^2)}$$

- (b) Using the method of separation of variables, solve

$$\frac{\partial u}{\partial x} = 2 \frac{\partial u}{\partial t} + u, \text{ where } u(x, 0) = 6e^{-3x}. \quad 10$$

Or

(a) If  $\vec{R} = xi + yj + zk$ , prove that : 10

(i)  $\text{div} (r^n \vec{R}) = (n + 3) r^n$ .

(ii)  $\text{curl} (r^n \vec{R}) = 0$

(b) Using Divergence theorem to evaluate : 10

$$\int_S \vec{F} \cdot d\vec{S},$$

where  $\vec{F} = x^3i + y^3j + z^3k$  and  $S$  is the surface of the sphere  $x^2 + y^2 + z^2 = a^2$ .

Or

(a) Find the directional derivative of  $f = xy^2 + yz^3$  at the point  $(2, -1, 1)$  in the direction of vector  $i + 2j + 2k$ . 10

(b) Show that the vector field given by : 10

$$\vec{F} = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$$

is irrotational and find the scalar potential.

(a) Compute by Fisher's index formula the quality index from the data given below : 10

Articles	Price	Total Value	Price	Total Value
A	12	36	10	40
B	10	100	8	96
C	16	96	14	98

(b) Fit a second degree parabola to the following data : 10

x	y
1.0	1.1
1.5	1.3
2.0	1.6
2.5	2.0
3.0	2.7
3.5	3.4
4.0	4.1

(a) Find the mean and variance of Binomial Distribution. 10

(b) Fit a Poisson distribution to the following : 10

x	y
0	46
1	38
2	22
3	9
4	1