



RN-6149

B. E. II (Sem. III) (Civil) Examination
May / June - 2010
Engg. Mathematics & Statistical Method

Time : 3 Hours]

[Total Marks : 100

Instructions :

(1)

नीचे दृश्यावेक निशानीवाणी विगतो उत्तरवही पर अवश्य लभवी.
Fillup strictly the details of signs on your answer book.

Name of the Examination :

Name of the Subject :

Subject Code No. : Section No. (1, 2,.....) :

Seat No. :

Student's Signature

- (2) All questions are compulsory.
- (3) Write each section in separate answerbooks.

SECTION - I

1 (a) Do as directed : 10

- (1) Define divergence of a vector function.
- (2) Give the relation between cartesian and spherical co-ordinates.

(3) Evaluate $\int_0^a \int_0^{\sqrt{ay}} xy \, dx \, dy$.

(4) Define beta function and show relation between beta and gamma function.

(5) Convert into polar form $\int_0^{2a} \int_0^{\sqrt{2ax-x^2}} x^2 \, dy \, dx$.

(b) Any three : 12

(1) Evalaute $\int_0^{4a} \int_{x^2/4a}^{2\sqrt{ax}} dy \, dx$ by changing the order of

integration.

- (2) Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z} dz dy dx$.
- (3) Evaluate $\iint_R \sqrt{xy-y^2} dA$, where R is the triangle with vertices (0,0), (10,1), (1,1).
- (4) Find the area enclosed by the curve $r = \sin 3\theta$.

2 (a) Attempt any **one** : 6

- (1) Verify Green's theorem for $\vec{F} = (x^2 + y^2)i - 2xyj$ and C is the rectangle in xy-plane bounded by $y=0$, $y=b$, $x=0$, $x=a$.
- (2) Verify stokes theorem for $\vec{F} = yi + zj + xk$, where S is the upper half of the sphere $x^2 + y^2 + z^2 = 1$ and C is its boundary.

(b) Attempt any **two** : 8

- (1) Find the directional derivative of $\phi = 3e^{2x-y+z}$ at $A(1,1,-1)$ in the direction \vec{AB} where B is the point (-3,5,6).
- (2) A vector field is given by $\vec{F} = (x^2 + xy^2)i + (y^2 + x^2y)j$ show that \vec{F} is irrotational and find its scalar potential.
- (3) Prove that $div(\text{grad } r^n) = n(n+1)r^{n-2}$.

3 (a) State and derive duplication formula for beta and gamma function. 4

(b) Attempt any **two** : 10

- (1) Evaluate $\int_0^\infty \frac{x^c}{e^x} dx$.
- (2) Evaluate $\int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin \theta}} \int_0^{\pi/2} \sqrt{\sin \theta} d\theta$.
- (3) Evaluate $\int_0^1 \frac{dx}{\sqrt{1-x^4}}$.

SECTION - II

- 4 (a) Do as directed : 10
- (1) Find one solution of $pz = qz = z^2 + (x + y)^2$.
 - (2) Write an IBVP for wave equation.
 - (3) Write the properties for a probability function for a continuous random variable.
 - (4) Check whether $f(x) = \frac{x^2}{25}$, $x = 0, 1, 2, 3, 4$ is a probability function.
 - (5) Find $P(-1 \leq z \leq 1)$.
- (b) Explain and solve one dimensional wave equation. 8
- OR**
- (b) Determine the solution of one-dimensional heat equation $u_t = c^2 u_{xx}$, where the boundary conditions are $u(0, t) = 0$, $u(l, t) = 0$ ($t > 0$) and $u(x, 0) = x$, l being the length of the bar. 8
- 5 (a) Solve any **two** : 6
- (1) $xp + yq = 3z$
 - (2) $(y - z)p + (x - y)q = z - x$
 - (3) $p \tan x + q \tan y = \tan z$
- (b) Attempt any **two** : 10
- (1) Six dice are thrown 729 times. How many times do you expect at least three dice to show a five or six ?
 - (2) Assume that the probability of an individual coalminer being killed in a mine accident during a year is $\frac{1}{2400}$. Use Poisson's distribution to calculate the probability that in a mine employing 200 miners there will be at least one fatal accident in a year.
 - (3) A sample of 100 dry battery cells tested to find the length of life produced the following results $\bar{x} = 12$ hours, $\sigma = 3$ hours. Assuming the data to be normally distributed, what percentage of battery cells are expected to have life more than 15 hours. (S.N.V.Z. area between 0 and 1 is 0.3413)

- 6 (a) Define statistic χ^2 . Write the conditions for application of χ^2 test. 4

- (b) Attempt any two : 12

- (1) The following are measurements of the air velocity (x cm/sec) and evaporation coefficient of burning fuel droplets in an impulse engine :

<i>x</i>	20	60	100	140	180	220	260	300	340	380
<i>y</i>	.18	.37	.35	.78	.56	.75	1.18	1.36	1.17	1.65

Fit a straight line to these data.

- (2) The following table gives the number of accidents that took place in an industry during various days of the week. Test if the accidents are uniformly distributed over the week.

<i>Day</i>	<i>Mon</i>	<i>Tue</i>	<i>Wed</i>	<i>Thur</i>	<i>Fri</i>	<i>Sat</i>
<i>No. of accidents</i>	14	18	12	11	15	14

- (3) The heights and weights of five students are given below

<i>Height in cm</i>	160	161	162	163	164
<i>Weight y kg</i>	50	53	54	56	57

Find correlation coefficient.