BACHELOR OF ENGINEERING IN CIVIL ENGINEERING (EVENING) EXAMINATION, 2017 (OLD)

(1st Year, 2nd Semester)

MATHEMATICS - II

Time : Three hours Full Marks : 100

Answer any *six* questions.
Four marks are reserved for neatness.
(Notations have their usual meanings)

1. (a) Show that the vectors (i – 2j + 3k), (-2i + 3j - 4k) and (- j + 2k) are coplanar.

 (b) Find the angle between the vectors **a** = 2i + 2j – k and **b** = 3i + 4k.

 (c) In any triangle ABC, with usual notations, prove that

 $$c^2 = a^2 + b^2 - 2abcosC.$$ 5+5+6

2. (a) If the vectors α = i + j + k, β = i – j + 2k and γ = 2i – j + k, then find the vector ρ, which satisfies ρ . α = 2, ρ . β = 1 and ρ . γ = 5.

 (b) If the vectors α = i + j - 6k, β = i – 3j + 4k and γ = 2i – 5j + 3k, then Find α . (β x γ) and α x (β x γ).

 (c) Show that $[\ \alpha + \beta,\ \beta + \gamma,\ \gamma + \alpha\ ] = 2[\ \alpha\beta\gamma\ ]$. 5+6+5

3. (a) If $\mathbf{F} = (3x^2y - z)\mathbf{i} + (xz^3 + y^4)\mathbf{j} - 2x^3z^2\mathbf{k}$, then evaluate grad div **F** at the point (2, -1, 0).

 (b) Show that the vector $\mathbf{V} = (x + 3y)\mathbf{i} + (y + az)\mathbf{j} + (x + az)\mathbf{k}$ is solenoidal, if a = -2.

 (c) Show that the vector

 $$\mathbf{F} = (2x - yz)\mathbf{i} + (2y - zx)\mathbf{j} + (3xz^2 - y)\mathbf{k}$$

 is irrotational. For **F**, find a scalar function φ, such that **F** = grad φ. 5+5+6

4. (a) Let $u = 4x^6 + 3x - 9$. Find the relative percentage error in computing u at x = 1.1 if the error in x is 0.05.

 (b) Using Newton's formula, find a polynomial which takes on the following values

x	0	1	2	3	4	5
y	41	43	47	53	61	71

 (c) Compute by the Newton-Raphson method the positive root of the equation $3x^2 + 2x = 9$ correct upto four significant figures. 4+6+6

5. (a)Use suitable interpolation formulae to compute f (0.33) and f(0.65) from the following data :

x	0.3	0.4	0.5	0.6	0.7
y	0.6179	0.6554	0.6915	0.7257	0.7580

(b) Calculate by Simpson's one-third rule the value of

$$\int_{1.2}^{1.6}\left(x+\frac{1}{x}\right)dx$$

Correct upto two significant figures, taking four intervals. 10+6

6. (a) Evaluate approximately, by trapezoidal rule, the integral

$\int_0^1 (4x-3x^2)dx$ by taking n = 10.

Compare the exact integral and find the absolute and relative error.

(b) Show that the polar form of Cauchy-Riemann equations are

$$\frac{\partial u}{\partial r}=\frac{1}{r}\frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r}=-\frac{1}{r}\frac{\partial u}{\partial \theta}$$

Hence deduce that 7 + 9

$$\frac{\partial^2 u}{\partial r^2}+\frac{1}{r}\frac{\partial u}{\partial r}+\frac{1}{r^2}\frac{\partial^2 u}{\partial \theta^2}=0.$$

7. (a) A bag X contains 2 white and 3 red balls and a bag Y contains 4 white and 5 red balls. One ball is drawn at random from one of the bags and is found to be red. Find the probability that it was drawn from bag Y.

(b) A random variable X has the following probability function:

Values of X,	x :	0	1	2	3	4	5	6	7
	p(x):	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2 + K$

Find K, (ii) Evaluate P(X<6), P(X≥6), p(3<X≤ 6) and (iii) Find the minimum value of x so that P(X≤ x) > 1/2. 6 + 10

8. (a) A problem in mechanics is given to three students A, B, C whose chances of solving it are 1/2, 1/3, 1/4 respectively. What is the probability that the problem will be solved?

(b) Obtain the median for the following frequency distribution:

x:	1	2	3	4	5	6	7	8	9
f:	8	10	11	16	20	25	15	9	6

(c) Compute the arithmetic mean for the following data:

Height (in cm) :	219	216	213	210	207	204	201	198	195
No. Of persons:	2	4	6	10	11	7	5	4	1

5+5+6