

**Karnataka Sangha's  
MANJUNATHA COLLEGE OF COMMERCE &  
JUNIOR COLLEGE OF COMMERCE**

**Preliminary Exam- I**

**Subject: Mathematics & Statistics**

**Date: 09.12.2019**

**Time: 3 Hrs**

**Class: S.Y.J.C**

**Marks: 80**

**SECTION-I**

**Q.1 Attempt Any Six:**

**12**

- i) If p: Tanmay is a student  
q: Tanmay likes to watch cricket match  
Give verbal statements to describe the following:  
a)  $\sim p \vee \sim q$  b)  $\sim p \rightarrow q$
- ii) Write Negation of following statements:  
a) All parents care for their children.  
b)  $\forall n \in \mathbb{N}, n + 7 > 6$
- iii) Find the values of x & y if  
$$\left\{ \begin{bmatrix} 1 & 1 \\ 2 & 3 \end{bmatrix} - \begin{bmatrix} 2 & 2 \\ 3 & 1 \end{bmatrix} \right\} \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix}$$
- iv) Find  $\frac{dy}{dx}$  if  $x = \tan^{-1} \theta, y = \theta^3$ .
- v) Find  $\frac{dy}{dx}$  if  $y = \tan^{-1} (\cot 2x)$
- vi) Evaluate  $\int x \cdot \log x \, dx$
- vii) The price p for demand D is given as  $p = 183 + 120D - 3D^2$ , find D for which price is increasing.
- viii) Evaluate  $\int_0^{\pi/2} \frac{1}{1 + \cos x} \, dx$

**Q.2 A) Attempt Any Two:**

**6**

- i) Solve the following equations by reduction method  
 $x + y + z = 6$   
 $3x - y + 3z = 10$   
 $5x + y - 4z = 3$
- ii) Evaluate  $\int \frac{1}{7 + 6x - x^2} \, dx$
- iii) Evaluate  $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} \, dx$

**B) Attempt Any Two:**

**8**

- i) If  $f(x) = \begin{cases} \frac{e^{2x} - 1}{ax} & \text{for } x < 0 & a \neq 0 \\ 1 & \text{for } x = 0 \\ \frac{\log(1+7x)}{bx} & \text{for } x > 0 & b \neq 0 \end{cases}$   
Is continuous at  $x=0$ , then find a and b.
- ii) Find MPC, MPS, APC & APS if the expenditures  $E_c$  of a person with income I is given as  $E_c = (0.0003) I^2 + (0.075) I$  when  $I=1000$ .
- iii) Using truth table, prove the following logical equivalences:  
 $p \leftrightarrow q \equiv \sim (p \wedge \sim q) \wedge \sim (q \wedge \sim p)$

**Q.3A) Attempt Any Two:**

**6**

- i) Find inverse of A by adjoint method:  
$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & 4 \\ 0 & 0 & 5 \end{bmatrix}$$
- ii) Find the volume of solid generated by rotating the area bounded by  $x^2 + y^2 = 36$  and the lines  $x=0, x=3$  about x-axis.
- iii) Evaluate  $\int \frac{2x+11}{(x-2)(x+1)} \, dx$

**B) Attempt Any Two:**

- i) If  $\tan\left(\frac{x+y}{x-y}\right) = a$  then show that  $\frac{dy}{dx} = \frac{y}{x}$
- ii) The total revenue of a transistor company is  $R = 2x^3 - 54x^2 + 390x$ . Find the number of transistors ( $x$ ) to be produced and sold so as to maximize the revenue.
- iii) If  $f$  is continuous at  $x = 0$  then find  $f(0)$  where  $f(x) = \frac{15^x - 3^x - 5^x + 1}{x \tan x}$   $x \neq 0$ .

**SECTION-II****Q.4 Attempt Any Six:**

- i) An agent charges 8% commission plus a 2% delcredere. If he sells goods worth Rs.12,400, find his total earnings.
- ii) Find Age-Specific Death Rate (Age-SDR) for the following data:

Age Groups (in years)	Population (in '000)	Number of Deaths
0-10	11	275
10-20	12	180
20-60	9	81
60 & Above	2	32

- iii) For bivariate data  $\bar{x} = 53$ ,  $\bar{y} = 28$ ,  $b_{yx} = -1.5$  and  $b_{xy} = -0.2$ . Estimate  $Y$  when  $X = 50$ .
- iv) For the following probability distribution of  $x$ , Find the value of  $k$ .

$x$	0	1	2	3	4
$P(x=x)$	$k$	$2k$	$4k$	$2k$	$k$

- v) If  $x$  has a binomial distribution with  $n = 20$  and  $p = \frac{1}{10}$ , Find  $E(x)$  &  $V(x)$ .
- vi) If  $b_{yx} = 0.9$  and  $b_{xy} = 0.6$  then find correlation coefficient between  $x$  and  $y$ . Comment on it.
- vii) From the following table gives the age of husbands and age of wives.

Age of Wives (in yrs)	Age of husbands (in yrs)			
	20-30	30-40	40-50	50-60
15-25	5	9	3	-
25-35	-	10	25	2
35-45	-	1	12	2
45-55	-	-	4	16
55-65	-	-	-	4

Find:

- a) the marginal distribution of age of husbands.
- b) the conditional distribution of age of husbands when age of wives lies between 25-35
- viii) Find  $\text{cov}(x, y)$  if  $r = 0.5$ ,  $\sigma_x = 1$ ,  $\sigma_y = 4$ .

**Q.5 A) Attempt Any Two:**

- i) Calculate CDR of A of B and compare them.

Age-Group (years)	Town A		Town B	
	Population (in '000)	No. of Deaths	Population (in '000)	No. of Deaths
0-5	25	550	20	440
5-15	40	280	30	210
15-35	60	720	40	480
Above 35	15	525	30	1050

- ii) The equation of two regression lines are  $10x - 4y - 80 = 0$  and  $10y - 9x - 40 = 0$ . Find  $\text{var}(X)$  if  $\text{var}(Y) = 36$ .
- iii) Find the values  $L_4$ ,  $T_5$  and  $e^0_4$ , given  $l_4 = 756$ ,  $l_5 = 453$ ,  $T_4 = 968$ .

**B) Attempt Any Two:**

8

- i) Calculate Spearman's Rank correlation coefficient between the following marks given by two judges (A) & (B) to eight contestants in the elocution competition:

Contestants	1	2	3	4	5	6	7	8
Marks by A	81	72	60	33	29	11	56	42
Marks by B	75	56	42	15	30	20	60	80

- ii) Find elapsed time and idle time of each machine  $M_1, M_2, M_3$ .

Jobs	I	II	III	IV
Machines $M_1$	12	6	5	11
Machines $M_2$	7	8	3	4
Machines $M_3$	13	14	11	15

- iii) How should the tasks be assigned to machines to minimize requirement of machine hours?

Tasks	Machines			
	Processing time (in hrs)			
	A	B	C	D
I	51	82	49	62
II	32	39	59	75
III	37	49	70	61
IV	55	60	58	62

**Q.6 A) Attempt Any Two:**

6

- i) Maximize  $Z = 60x + 50y$   
 Subject to  $x + 2y \leq 40$   
 $3x + 2y \leq 60$   
 $x \geq 0, y \geq 0$ .
- ii) Salma wants to invest Rs.24,000 in public provident fund (PPF) and in National Bonds. She has to invest at least Rs.1000 in PPF and at least Rs.2000 in bonds. If the rate of interest on PPF is 9% per annum and that on bonds is 8% per annum, how should she invest her money to earn maximum annual income? Also, find maximum annual income.
- iii) A cargo of rice was insured at  $\frac{5}{8}\%$  to cover 80% of its values. The premium paid was Rs.5,250. If the rice was worth Rs.21 per kilo how many kilos of rice did the cargo contain?

**B) Any Two:**

8

- i) Find the rate of interest compounded per annum if an annuity immediate at Rs.10,000 per year amounts to Rs.1,30,000 in 3 years.
- ii) A bill drawn on 3<sup>rd</sup> June for 6 months was discounted at the rate of 5% on 17<sup>th</sup> October. If cash value of bill is Rs.43,500, find face value of the bill.
- iii) If  $X$  follows Poisson distribution such that  $P(X=1)=0.4$  and  $P(X=2)=0.2$ . Find  $P(X=0)$  and  $P(X=3)$ .  
 (Use  $e^{-1}=0.3678$ )

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