# 2020

# MATHEMATICS HONOURS

## Paper: 3

## Internal Assessment

## SET-2

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Notations and symbols have their usual meaning.

**Full Marks: 50**                                                    **Time:2 Hours**

## MODULE  V

## Group-A

## Full Marks-10

Answer **Question No. 1** and **any one** from the rest.

1.      Answer any one questions:                                    1x5=5

(a)     Write down approximate representation of $\dfrac{5}{6}$ correct upto four significant digits and find

the   percentage error.

(b)     Given $f(-1)=1,\ f(0)=1,\ f(2)=-5,\ $ find $f(1)$.

(c)     Round off the numbers 0.004935 and 825.95 to three significant digits.

(d)     Prove that $E\left(\Delta f(x)\right)=\Delta\left(Ef(x)\right)$

2.      Given: $\begin{array}{ccccc} x: & 2 & 2.1 & 2.2 & 2.3 \\ f(x): & 0.9415 & 0.9532 & 0.9689 & 0.9865 \end{array}$, Compute $f(2.15)$.          5

3. Evaluate $\displaystyle\int_{0}^{1}\left(4x-3x^2\right)dx$ , taking 10 intervals by Trapezoidal Rule correct to two decimal

   places.                                                           5

4. Using bisection method find the positive root of $x^3 2x-5=0$ correct uptofour significant

   figures.                                                          5

# Group-B
## Full Marks-15
Answer **Question No. 5** and **any one** from the rest.

5.    Answer any two questions:    2x4=8

(a)    Draw graphically the feasible region, if any, of the following inequations:

$$x_1 + 2x_2 \leq 3$$
$$3x_1 + x_2 \geq 3$$
$$x_1, x_2 \geq 0.$$

(b)    Examine if the vectors (3,4,5), (2,-3,1), (-3,1,2) form a basis of $E^3$.

(c)    What do you mean by linearly dependent vectors?

(d)    Define convex set with an example.

(e)    Using Matrix Minima Method find the initial basic feasible solution of the following transportation problem.

|  | $D_1$ | $D_2$ | $D_3$ | $a_i$ |
|---|---|---|---|---|
| $O_1$ | 10 | 8 | 7 | 10 |
| $O_2$ | 6 | 9 | 8 | 5 |
| $b_j$ | 6 | 3 | 6 | |

6.    x=1, y=1, z=1 is a solution of the following set of equations:

2x+3y+5z=13

3x-y+3z=4

Reduce this solution to a basic feasible solution.    7

7.  Solve the following L.P.P graphically.

Maximize $z = 5x_1 + 7x_2$

Subject to $3x_1 + 8x_2 \leq 12,$

$x_1 + x_2 \leq 2,$

$2x_1 \leq 3,$

$x_1, x_2 \geq 0$ .    7

8.    Solve the following L.P.P. by Charnes Big M-method.

Minimize $z = 4x_1 + 3x_2$

Subject to $x_1 + 2x_2 \geq 8,$

$3x_1 + 2x_2 \geq 12,$

$x_1, x_2 \geq 0.$    7

9.    Obtain an optimal basic feasible solution and corresponding cost of the following transportation problem:

|        | $D_1$ | $D_2$ | $D_3$ | $D_4$ | $a_i$ |
|--------|-------|-------|-------|-------|-------|
| $O_1$  | 6     | 4     | 2     | 7     | 8     |
| $O_2$  | 5     | 1     | 4     | 6     | 14    |
| $O_3$  | 6     | 5     | 2     | 5     | 9     |
| $O_4$  | 4     | 3     | 2     | 1     | 11    |
| $b_j$  | 7     | 13    | 12    | 10    |       |

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Answer either **Group-A** or **Group-B**

**Group-A**

**(Analytical Dynamics)**

**Marks-25**

Answer *Question NO. 10* and *any one* questions from the rest

10.      Answer any *two* questions:                                2x8=16

a)      What is the horse power of the engine which keeps a train moving with velocity v ft/sec against a resistance of R poundals?

b)      If the velocity of any particle moving along x-axis is given by $v^2 = 7bx - x^2 - 2b^2$, check if the motion is S.H.M.

c)      A heavy ball is dropped from a height h on horizontal floor. If e be the coefficient of elasticity, find the loss of potential energy due to first impact.

d)      What do you mean by 'impulsive force'?

e)      Show that in a central orbit the angular momentum of the particle about the origin is always constant.

f)      State Newton's 1$^{st}$ law of motion and prove it.

g)      If the radial velocity of a particle is proportional to its cross-radial velocity, find the path in polar coordinates.

h)      A particle moves along the curve r=acotθ under a central force. Find velocity of the particle in terms of r.

11. Find the tangential and normal components of velocity and acceleration of a particle moving in a plane.                                                9

12. Show that for a projectile in vacuum the sum of kinetic and potential energies is constant throughout the motion.                                                9

13. A particle moving in a straight line has the following relation between the velocity $v$ and the distance $x$ from the origin $v = \sqrt{\dfrac{\mu - x}{x}}, \mu > 0.$ show that the motion is simple harmonic.

                                                                                9

14. Find the law of force to the pole when the path is $r = a(1 - \cos\theta)$ and prove that if $F$ be the force, $a$ the apse and $v$ the velocity, then $3v^2 = 4aF$.                                9

15. Establish the differential equation $\dfrac{h^2}{p^3}\dfrac{dp}{dr} = F$ of the particle describing a central orbit under an attractive force F per unit mass. 9

## Group-B
### (Probability and Statistics)
### Marks-50

Answer **Q.16** and any **two** from the rest

16. Answer any two questions: 2×8=16

a) Define random experiment with an example.

b) The first four central moments of a distribution are 0, 3.5, 0.9 and 24.75. Calculate coefficient of skewness and kurtosis.

c) What is the chance that a leap year selected at random will contain 53 Mondays?

d) If $b_{yx} = 1.5$, $\bar{x} = 5$ and $\bar{y} = 7$ find the regression equation of y on x.

e) Write down the p.d.f for aF Distribution with n degrees of freedom.

f) Define mutually exclusive events with a proper example.

g) Prove that A.M is greater than or equal to G.M.

h) Define time series.

i) What is the difference between distribution of sample and sampling distribution?

17. Define conditional probability. For any two sets A and B, prove that
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ 9

18. The following is the distributions of expenditure of 1000 families:

| Expenditure(Rs.) | 40-59 | 60-79 | 80-99 | 100-119 | 120-139 |
|---|---|---|---|---|---|
| No. of Families | 50 | - | 500 | - | 50 |

The mean and median of the distribution are both Rs.87.50. Determine the missing frequencies.

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19. Calculate the coefficient of correlation of the data given below. Determine also the regression line of Y on X and then make an estimate of the value of Y when X=5.8.

| X | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|
| Y | 15 | 16 | 14 | 13 | 11 | 12 | 10 | 8 | 9 |

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20. Fit a straight line to the following data by the method of least square:

| Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|

| Production('000 tons) | 76 | 87 | 95 | 81 | 91 | 96 | 90 |
|---|---|---|---|---|---|---|---|

16

21. In the city A, 20% of a random sample of 900 school children had defective eye-sight. In the city B, 15% of a random sample of 1600 school children had the same defect. Is this difference between the two proportions significant? Obtain 95% confidence limits for the difference in the population proportions.

Given $P(-1.96 \le Z \le 1.96) = 0.95$ where Z is standard normalvariate.  9

22. Find the index number using the data given below:

| Com. | Base Price 2005 | Current Price 2010 | Weight |
|---|---|---|---|
| Rice | 36 | 54 | 10 |
| Pulse | 30 | 50 | 3 |
| Fish | 130 | 155 | 2 |
| Potato | 40 | 35 | 4 |
| Oil | 110 | 110 | 5 |

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