16DSMA004

Enrolment No.

S_5 (DSMA35B12): MA

BSMS-5th SEMESTER, MID-TERM EXAMINATION-2018

Subject Name: Linear Programming and Game Theory

Subject Code: DSMA35B12

Full Marks: 50 **Time: 2 hours**

Symbols used here have their usual meanings

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Group A

[25 Marks]

Answer question no. 1 and any three out of 2 to 5.

1. Define convex set and extreme point or vertex. Prove that the objective function of a LPP assumes its optimal value at the extreme (vertex) point of the convex set of the feasible reason. [2+5]

2. (a) Define convex combination and convex hull.
(b) Graph the convex hull of the points: (0, 0), (0, 1), (1, 2), (1, 1), (4, 0). Express the interior point as a convex combination of the extreme points. [2+4]

3. Food X contains 6 units of vitamin A and 7 units of vitamin B per gram and costs 12 p./gm. Food Y contains 8 units and 12 units of A and B per gram respectively and cost 20 p./gm. The daily requirement of vitamin A and B are at least 100 units and 120 units respectively. Formulate the above as an LPP to minimize the cost. Also solve the formulated LPP graphically. [6]

4. What do you mean by BFS to an LPP? By using simplex method find a BFS to the following LPP, which is also optimal [1+5]

$$\max\ z = x_1 + x_2 + 3x_3$$
$$s.t.\quad 3x_1 + 2x_2 + x_3 \le 3,$$
$$2x_1 + x_2 + 2x_3 \le 5,$$
$$x_1, x_2, x_3 \ge 0.$$

5. Define artificial variable. Use either two-phase or Big M method to solve the following LPP [1+5]

$$\max\ z = 2x_1 + 3x_2 + x_3$$
$$s.t.\quad -3x_1 + 2x_2 + 3x_3 = 8,$$
$$-3x_1 + 4x_2 + 2x_3 = 7,$$
$$x_1, x_2, x_3 \ge 0.$$

Group B

[25 Marks]

Answer all the questions.

1. (a) Prove that, if a constant be added to any row and / or any column of the cost matrix of an assignment problem, then the resulting assignment problem has the same optimal solution as the original problem.

(b) Describe modified distribution method for finding optimal solution of a transportation problem. [5+5]

2. A product is produced by four factories A, B, C and D. The unit production costs in them are Rs. 2 , 3, 1 and 5 respectively. Their production capacities are : factory A- 50 units, B-70 unites, C- 30 unites and D-50 unites. These factories supply the product to four stores, demands of which are 25, 35, 105 and 20 unites respectively. Unit transport cost in rupees from each factory to each store is given in the table below.

STORES

FACTORIES		1	2	3	4	
A	2	2	4	6	11	50
B	3	10	8	7	5	70
C	1	13	3	9	12	30
D	5	4	6	8	3	50
		25	35	105	20	

Determine the extent of deliveries from each of the factories to each of the stores so that the total production and transportation cost is minimum. [10]

3. (a)Find the minimum cost solution for the 4 X 4 assignment problem whose cost coefficients are as given below [5]

4	5	3	2
1	4	-2	3
4	2	1	-5

OR

(b) Write the short note on (i) impossible assignment (ii) degeneracy transportation problem. [5]

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$2-\frac{3}{2}=\frac{4-3}{2}=\frac{1}{2}$

$2-\frac{1}{2}=\frac{4-1}{2}$ $\quad 5-\frac{3}{2}=\frac{10-3}{2}$

$\frac{7}{2}\times\frac{2}{3}$

$\frac{3}{2}-\frac{1}{3\times 2}$ $\quad \frac{1}{2}-\frac{3}{2}\times\frac{1}{3}$

$-\frac{2}{3}+\frac{2}{3}$ $\quad -3$ $\quad \frac{3}{2}-\frac{1}{3}\times\frac{7}{2}$ $\quad \frac{2}{3}\times\frac{2}{2}$

16DSMA004

Enrolment No.

S₅(DSMA35B13)MA

BS-MS 5th SEMESTER, MID-TERM EXAMINATION-2018
NAME OF THE SUBJECT: Statics and Dynamics
CODE NO: DSMA35B13

Full Marks: 50 **Time: 2 hours**

Symbols used here have their usual meanings

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Group-A(Statics)

Answer all the following questions

Total Marks: 25

1. StateLemi's theorem. Forces act through the angular points of a triangle perpendicular to the opposite sides, and are proportion to the cosines of the corresponding angles, show that their resultant is proportional to $\sqrt{(1-8cosAcosBcosC)}$. [1+5]

2. Define Astatic equilibrium. The algebraic sums of the moments of a system of coplanar forces about points whose co-ordinates are $(1,0), (0,2)$, and $(2,3)$ referred to rectangular axes are G_1, G_2, G_3 respectively. Find the tangent of the angle which the direction of the resultant force makes with the axes of x. [1+5]

10

3. State the **Principle of virtual work for coplanar forces.** Four equal rods, each of length a and weight W are joined to form a rhombus ABCD and the joints B and D are jointed by a string of length l. The system is placed in a vertical plane with A resting on a horizontal plane and AC vertical. Prove that the tension of the string is $\frac{2Wl}{\sqrt{4a^2-l^2}}$. [2+5]

4. What does the **Energy test for stability** state? A heavy uniform rod rests with one end against a smooth vertical wall and with a point in its length resting on a smooth peg. Find the position of equilibrium and show that it is unstable. [2+4]

Group-B (Dynamics)

Answer any five (05) from the following questions:

Total Marks: 25

1. A particle leaves the origin with velocity u. if it moves with an acceleration $\frac{\mu}{v^2}$, v being the velocity at any instant, then show that the distance x described in time t is given by
$$4\mu x = (3\mu t + u^3)^{\frac{4}{3}} - u^4.$$
[5]

2. What is **Damped Forced Oscillation**. A particle is moving in a straight line with an acceleration $\mathbf{n^2 \times (distance)}$ towards a fixed point in the line, in a medium which offers a resistance proportional to velocity and is simultaneously acted on by a periodic disturbing force $\boldsymbol{Fcospt}$ per unit mass. Determine its motion. [1+4=5]

3. Derive radial and transverse components of velocity and acceleration of a moving particle along a plane curve. [5]

4. A particle moves in one plane under a force which is always perpendicular and towards a fixed straight line on the path. Its magnitude being $\mu \div (\boldsymbol{distance\ from\ the\ line})^2$. If

initially it be at a distance $2a$, from the line and be projected with a velocity $\sqrt{\frac{\mu}{a}}$ parallel to the line, prove that the path traced out is a cycloid.

[5]

5. What is **Central force**? Show that the differential equation of the path under central forces in polar coordinates is $\frac{d^2u}{d\theta^2} + u = \frac{F}{h^2u^2}$.

[1+4=5]

6. A particle of mass m moves under a central attractive force $m\mu(5u^3 + 8c^2u^5)$ and is projected from an apse at a distance c with velocity $3\sqrt{\mu}/c$; prove that the orbit is $r = c\cos(\frac{2}{3})\theta$, and that it will arrive at the origin after a time $\pi c^2/8\sqrt{\mu}$.

[5]

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$$\frac{d^2x}{dt^2}$$

$$= \frac{d}{dt}\left(\frac{dx}{dt}\right)$$

$$= \frac{d}{dt} \cdot v\frac{dv}{dx}$$

16DSMA004

Enrolment No. [| | | | | | |]

S5(DSMA35B15): MA

BSMS 5th SEMESTER MID TERMEXAMINATION – 2018

SUBJECT NAME: Fuzzy Mathematics, Rough Sets and Applications

SUBJECT CODE : DSMA35B15

Time: 2 Hours

Full Marks: 50

Symbols used here have their usual meanings

Group-A

Answer all the following questions:

1. a) Define α –level set and convex fuzzy set.
   b) Let $\tilde{A}(x) = \{(3,.5),(5,1),(7,.6)\}$ and $\tilde{B}(x) = \{(3,1),(5,.6)\}$. Find the followings:
   i) $\tilde{A} + \tilde{B}$ and ii) $\tilde{A} \ominus \tilde{B}$.
   c) What is the relation between t-norm and s-norm?
   d) Define L-R representation of a fuzzy interval.
   e) Let $\tilde{M} = (2,.2,.1)_{LR}$ and $\tilde{N} = (3,.1,.3)_{LR}$ be fuzzy numbers of LR-type with reference functions $L(z) = R(z) = \begin{cases} 1 & -1 \le z \le 1 \\ 0 & else \end{cases}$. Find $\tilde{M} \odot \tilde{N}$.

   [(1+1)+(2+2)+1+2+3] = 12

2. a) Define Idempotent Fuzzy Matrix with an example.
   b) Verify that $(A \leftarrow A')^2 = A \leftarrow A'$ where $A = \begin{bmatrix} 0.7 & 0.5 \\ 0.4 & 1 \\ 0 & 0.8 \end{bmatrix}$.
   c) If μ_1 and μ_2 are two fuzzy subsets of the set X then prove that $(\mu_1 . \mu_2)^c \equiv \mu_1^c + \mu_2^c$.
   d) Using operations of fuzzy numbers prove that $\mu_{\tilde{2}+\tilde{5}}(6) = \frac{2}{3}$, where $\mu_{\tilde{2}+\tilde{5}}(6) = \begin{cases} 0 & z < 4 \\ \frac{z-4}{3} & 4 \le z \le 7 \\ \frac{9-z}{2} & 7 < z \le 9 \\ 0 & z > 9 \end{cases}$ is fuzzy number.
   e) Define trapezoidal fuzzy number with a graph.

   [3+3+3+2+2] = 13

Group-B

Answer all the following questions:

1. a) State Zadeh's extension principle.
   b) Let $f: X_1 \times X_2 \to Y$ be a function defined by $f(x,y) = x^2 + y^2, (x,y) \in X_1 \times X_2$. Consider the fuzzy sets $A = ((-1,1),(0,0.4),(1,0.2),(2,0.5))$ and $B = ((-1,0.5),(0,0.08),(1,1),(2,0.4)$ on X_1 and X_2 respectively. Using Zadeh's extension principle find a fuzzy set in Y,

   [1+6]

2. a) Define soft set with example.
   b) Let $U = \{x_1, x_2, x_3\}$ be a set of cars and $A = \{x = \text{expensive},\ y = \text{manual gear}, z = \text{automatic gear}\}$ and $B = \{a = \text{blue},\ b = \text{red}, c = \text{white}\}$ be the soft set of parameters. Determine the following cars:
   i) blue and expensive car ii) red car with manual gear iii) white car white automatic gear

   [1+5]

3. a) Define Intuitionistic fuzzy numbers.
   b) Define indiscernibilty relation, upper approximation, lower approximation and boundary region of a rough set.

   [1+4]

4. a) Define type-2 fuzzy set with example.
   b) Let $A = (x, \mu_A(x)), B = (x, \mu_B(x))$ are two type -2 fuzzy set, where $\mu_A(3) = \{(0.8,1),\ (0.7,0.5),(0.6,0.4)\}$ and $\mu_B(3) = \{(1,1),\ (0.8,0.5),(0.7,0.3)\}$.
   Compute $A \cap B$.

   [2+5]

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ment No.

S$_5$(DSMA35B14), BRANCH: **Mathematics**

BSMS 5th Semester Mid-Term Examination–2018

Subject Name: **Integral Transforms & Applications**

Subject Code: **DSMA35B14**

Full Marks: 50 | Times: 2 Hours

Symbols used here have their usual meanings

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Group-A

Answer all the following questions

1. (i) Find Laplace transform of $J_0(t)$, where $J_0(t)$ is Bessel's function of zero order. (ii) Using Laplace transform, prove that $\int_0^\infty J_0(t) = 1$. [5]

2. Evaluate $\int_0^\infty e^{-t}\left(\frac{1}{t}\int_0^t e^{-u}\sin u\, du\right)dt$, by using Laplace transform. [5]

3. Solve $\int_0^t \frac{y(u)}{(t-u)^{\frac{1}{4}}}du = t^2(1+t)$, by using Laplace transform. [5]

4. An infinite string having one end at $x = 0$ is initially at rest along x –axis. The end $x = 0$ undergoes a transverse displacement $f(t)$, $t > 0$. Find displacement of the string at any time t. [5]

5. State convolution theorem. Evaluate $\int_0^\infty \frac{1-e^{-at}}{te^t}dt$. [5]

Group-B

Answer all the following questions

1. Show that if the series $\frac{1}{2}a_0 + \sum_{n=1}^\infty (a_n \cos nx + b_n \sin nx)$ converges uniformly to f on $[-\pi, \pi]$ then it is the Fourier series for f in $[-\pi, \pi]$. [5]

2. State and prove Bessel's inequality. [5]

3. Obtain the Fourier series expansion of the function $f(x) = x\sin x$ in $[-\pi, \pi]$. Hence deduce that
$$\frac{\pi}{4} = \frac{1}{2} + \frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \cdots$$
[5]

4. Using the expansion of the function x and x^2 in the interval $[0, \pi]$ in cosines of multiple of x, prove the equality: $\sum \frac{\cos nx}{n^2} = \frac{3x^2 - 6\pi x + 2\pi^2}{12}$, $0 \le x \le \pi$. [5]

5. Find the Fourier series of $f(x) = x^2 + x$ in $[-l, l]$ $(l \ge 1)$. Hence show that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \cdots = \frac{\pi^2}{6}$.

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$-\pi \le x \le \pi$ $a \le x \le b$ $\frac{\pi(2x-a)}{(b-a)}$ $\frac{(2x-a-b)}{b-a}$ $\frac{\pi(a-b)}{(b-a)}$ $-\pi < x < \pi$ $\int \frac{dx}{x^2+a^2} = \frac{1}{a}\tan^{-1}\frac{x}{a}$