BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
FIRST SEMESTER 2023-2024
COMPREHENSIVE EXAMINATION 2023-24 (PARTIALLY OPEN BOOK/NOTES)

COURSE NO.: BITS F469 TIME: 3 Hours
COURSE TITLE: Financing Infra Projects DATE: 27/12/2023
MAX. MARKS: 35%

Note: (i) Attempt all questions.
(ii) Make necessary assumptions, if required.
(iii) Mobile phones and computers of any kind should not be brought inside the examination hall.
(iv) Please follow all the Instructions to Candidates given on the cover page of the answer book. Use of any unfair means will result in severe disciplinary action.
(v) This part has two parts, (i) Part A, which is closed book and Part B, which is Open Book/notes. You are required to first answer questions of part A in Answer sheet for Part A. After completing Part A (closed book) portion of this question paper, submit answer sheet of part A to the invigilator and take another answer sheet to answer part B question paper, which open book.

PART A: CLOSED BOOK

Note: This part has 4 questions, which are Closed Book. All parts of a question should be answered consecutively.

Q.1 A water infrastructure project is proposed to supply water for municipal and irrigation uses. Municipal demand is given by P + 2Y = 10, and irrigation demand is given by 2P + Y = 20, where P is the price and Y is the demand. (i) Determine the aggregate demand curve. (ii) Assuming the total cost curve is given by $C = \frac{1}{4}Y^2 + Y$, determine the optimal level of Y.

[4 Marks]

Q.2 Two outputs can be produced from a production process such that the levels of the two outputs, *y*1 and *y*2, satisfy the relation, $y_1^2 + 4y_2^2 = 4$, keeping all other things constant. If the marginal benefits of *y*1 and *y*2, are respectively equal to 10 and 5, determine the optimum levels of *y*1 and *y*2. The output variables y1 and y2, for example, may represent, irrigated area and hydropower generated respectively. Assume that the water used for these two is mutually exclusive. Also explain under what conditions these two variables can be treated as mutually exclusive. **[4 Marks]**

Q.3 Two inputs x1 and x2 should be combined to satisfy the relationship $x_1x_2 = 16$, in order to produce constant results (output), all other things being the same. The input variables x1 and x2, for example, may represent the quantum of surface water and groundwater to provide a given level of irrigation to a given area. If the x1 and x2 are 4 and 1, respectively, determine the optimum values of x1 and x2. **[4 Marks]**

Q.4. Two alternative plans are considered for a section of an aqueduct. Plan A uses a tunnel, and Plan B uses a lined canal and steel flume. Both plans yield the same revenues over the life of the project. Compare the equivalent annual costs of the two plans and conclude your results if interest rate = 6% per year and study period of the project is 100 years.

	Plan A	**Plan B**		
Parameters	Tunnel	Canal	Canal lining	Flume
Life	100 yr	200 yr	20 yr	50 yr
Initial Cost (₹)	450,000	120,000	50,000	90,000
Annual O & M cost (₹)	4000	-	10,500	-

[3 Marks]

PRAT B: OPEN BOOK/NOTES

Note: This part has 3 questions, which are open Book/notes. All parts of a question should be answered consecutively. Each answer should start from a fresh page.

Q.5 Members of Willow Greek company emergency rescue squad for road accidents know from past experience that they will receive between zero and six emergency calls each night. According to following probability distribution. The rescue squad classifies the emergency calls into one of three categories: Minor, Regular and Major emergency. The probability that a particular call will be of each type is

Calls	Probability of Calls	Emergency type	Probability of Emergency type
0	0.05	Minor	0.30
1	0.12	Regular	0.56
2	0.15	Major	0.14
3	0.25		
4	0.22		
5	0.15		
6	0.06		

The type of emergency call determines the size of crew sent in response. Minor emergency call requires two persons, regular requires three person and Major emergency call requires five-person crew team. Simulate call received **for 10 nights** and determine the **maximum Number of crew members** that might be needed on any given night. **[7 Marks]**

Q.6 The Jaipur Infra Company produces two products- A and B. According to the past experience, construction of either product A or product B requires an average of one year at the site. The plant has a normal production capacity of 340 hours a month. The marketing department of the firm reports that because of limited market, the maximum number of product A and product B that can be sold in a month are 160 and 220 respectively. The net profit from he sale of product A and product B are Rs. 675 and Rs. 235 respectively. The manager has set the following goals.

P1 : The first goal is to avoid any underutilization of normal production capacity.

P2: He wants to sell maximum possible units of product A and B. Since the net profit from the sale of product A is thrice the amount from Product B, therefore, the manager has thrice as much desire to achieve sales for product A as for Product B.

P3: He wants to minimize the overtime operation of the plant as much as possible.

Show the objective function and goal constraints. Also present the goal constraints on a graph. **[7 Marks]**

Q.7 Consider the following situation and suggest appropriate financing method:

Vikram worked in R & D center of multinational company for about five years He quit the job and stated a VNR informatics Pvt Ltd with the objective of producing software's for real estate companies. At present the company has 1.5 Cr of capital contributed by promoters. For needs of the company, they need 1.5 Cr of additional capital.

Manas textiles a leading exporter of textiles to USA. The company's plant and equipment has been financed by the consortium of lenders. Lenders are not interested to further give any load to the company. The company buys the inputs in cash but offers 90 days credits its customers in US. Due to recent spurt in sales, company needs 50 cores of additional financing. **[6 Marks]**

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