

**National Institute of Technology Hamirpur  
Department of Chemical Engineering**

**B.Tech. 4<sup>th</sup> Year (Semester VII)  
End Semester Examination**

**Process Economics and Plant Design [CHD-412]**

**Max Marks: 50**  
**Exam Time: 2:00-4:00 PM**

**Time: 2.0 Hrs**

**Date: 09/12/20**  
**Submission Only Upto: 4:15 PM**

**INSTRUCTIONS**

- Write Name, Roll No, Program, Semester, Department, Subject Name and Subject Code, Date of Examination and number of pages on top of first sheet
- Put signature with date on bottom of each sheet of answer booklet
- Take the scan and make pdf (don't take photo) of the answer sheet, name the pdf of answer sheet as rollnumbersubjectcode.pdf and upload it on google class.
- If anyhow answer sheet can not be uploaded on google class then only email it on [rshyam@nith.ac.in](mailto:rshyam@nith.ac.in). Submission should be within 15 Minutes of end exam time. Late submission will lead to partial or zero marks
- Retain the hardcopies of answer sheets and handover after returning back to institute
- Use of appendices and tables uploaded on google class is allowed
- Make appropriate assumptions if needed

**Question 1.** A proposed chemical plant has the following projected revenues and operating expenses,

Year	Annual revenue (Rs. Crore)	Annual operating expenses (excluding depreciation) (Rs. Crore)
1	6	3.5
2	9	5
3	14	6.5
4	19	7.5
5	20	8

The fixed-capital investment for the plant is Rs 20 crore with a working capital of Rs 3 crore. Using straight line method of depreciation and zero salvage value recovery, determine, Discounted Cash Flow Rate of Return (DCFR). Assume tax free regime. Carry out only two iterations. **(10)**

**Question 2.** A company must purchase one reactor to be used in an overall operation. Four reactors have been designed, all of which are equally capable of giving the required service. The following data apply to the four designs:

	Design 1	Design 2	Design 3	Design 4
Fixed Capital Investment ( <b>in Crore</b> )	10	12	14	16
Sum of after-tax operating and fixed costs per year (all other costs are constant) ( <b>in Crore</b> )	3	2.8	2.4	2.1

If the company demands a 15 percent return after taxes on any unnecessary investment, which of the four designs should be accepted? **(10)**

**Question 3.** In the design of a chemical plant, the following expenditures and revenues are estimated after the plant has achieved its desired production rate:

Total capital investment: \$10,000,000

Working capital: \$ 1,000,000

Annual sales: \$8,000, 000/yr

Annual expenditures: \$2,000,000/yr

Assuming straight-line depreciation over a 10-year project analysis period and income tax rate of 25%, determine,

- a) The return on the investment after taxes
- b) The payback period **(10)**

**Question 4.** The initial cost of an equipment is Rs. 3, 000, 000. The rate of interest is 8% yearly and useful life of equipment is 10 years. The salvage value after useful life is Rs. 500, 000. Calculate amount of depreciation and book value of equipment after 3 years of operation using sinking fund method. **(10)**

**Question 5.** Very briefly discuss various heuristics for determining Input-Output structure of a flowsheet. **(10)**