

[5254]-36

B.E. (Mechanical Engineering)

DESIGN OF PUMPS, BLOWERS AND COMPRESSORS

(2008 Course) (Elective - I)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.*
- 2) Answer Three questions from section I and Three questions from section II.*
- 3) Answer to the two sections should be written on separate.*
- 4) Neat diagram must be drawn wherever necessary.*
- 5) Figures to the right indicate full marks.*
- 6) Assume suitable data, if necessary.*

SECTION - I

- Q1)** a) Explain performance characteristics of pump. **[8]**
- b) Write a note on stage velocity triangle. **[8]**

OR

- Q2)** a) What is specific speed? Explain its significance. **[8]**
- b) Explain the difference between fan, blower & compressor **[8]**

OR

- Q3)** a) Write short note on losses in pumps. **[8]**
- b) Draw operating characteristics curves for reciprocating pump. **[8]**
- Q4)** a) Write down steps involved in calculation of axial thrust methods to minimize axial thrust. **[8]**
- b) Enlist different applications of rotary & reciprocating pumps. **[8]**

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- Q5) a)** Write down steps for design procedure and design optimization of Pumps. [10]
- b) Explain various forms of corrosion occur in hydraulic machines. [8]

OR

- Q6) a)** Enlist steps for selection of impeller and casing dimension using industrial manuals for hydraulic design of pumps. [10]
- b) Explain following terms : [8]
- i) Static suction head
 - ii) Static discharge head
 - iii) Total suction head

SECTION - II

- Q7) a)** Explain design procedure & selection, optimization of blower. [8]
- b) Write a short note on “Applications of Fans & Blowers”. [8]

OR

- Q8) a)** What are main cause for noise generation? What are methods for reducing the fan noise? [8]
- b) How does dust erosion of centrifugal impeller occurs? What is its effect on the Performance? [8]

- Q9) a)** State design consideration and imperial relations used to determine various for design Parameters in fan & blowers? [8]
- b) Explain the terms Surging and Stalling. [8]

OR

- Q10)a)** Write a short note on “Design procedure for selection and optimization of Blowers”. [8]
- b) Write a short note on “Design of Impeller and casing dimensions in aerodynamic design. [8]

- Q11)a)** Explain the terms degree of reaction & Slip factor? [8]
- b)** An Axial compressor stage has the following data [10]
- | | |
|---|----------------|
| i) Temperature and Pressure at Entry | 300 K, 1.0 bar |
| ii) Degree of Reaction | 50 % |
| iii) Mean Blade ring diameter | 36 cm |
| iv) Rotational Speed | 18000 rpm |
| v) Blade Height at entry | 6 cm |
| vi) Air angles at rotor and stator exit | 25° |
| vii) Axial velocity | 180 m/s |
| viii) Work done factor | 0.88 |
| ix) Stage Efficiency | 85 % |
| x) Mechanical Efficiency | 96.7 % |

Determine :-

- A) Air angles at the stator and rotor entry
- B) The mass flow rate of air
- C) The power required to drive the compressor
- D) The loading coefficient
- E) The pressure ratio developed by the stage
- F) Mach number at the rotor entry

OR

- Q12)a)** Draw the velocity triangles at the entry and exit for the following axial compressor stage :- [8]
- i) $R = 1/2$
 - ii) $R < 1/2$
 - iii) $R > 1/2$

- b)** Air enters the inducer of centrifugal compressor at $P_{o1} = 1.02$ bar, $T_{o1} = 335$ K. [10]

The hub and tip diameters of the impeller eye are 10 and 25 cm respectively. If the compressor runs at 7200 rpm and delivers 5.0 kg/s of air. Determine the air angle at the inducer blade entry and the relative Mach number. If IGVs are used to obtain a straight inducer section, determine the air angle at IGVs exit and the new value of the relative mach number.

