

MODEL QUESTION PAPER
IV th SEMESTER B.TECH DEGREE EXAMINATION

13.405 FLUID MACHINERY(M)

Time: 3 hrs

Max. marks: 100

(Answer all questions in Part A and One full question from each module in Part B)

Part A

1. Explain the function of buckets in a Pelton wheel
2. What is the function of draft tube in reaction turbines?
3. What cavitation in hydraulic machines
4. Explain the term manometric efficiency of a centrifugal pump
5. Why impellers are connected in series in multi stage pumps
6. What is the use of air vessels in pumps?
7. What is the function of hydraulic accumulator?
8. Give a classification of air compressors
9. Explain the term volumetric efficiency of reciprocating air compressor
10. Sketch a Roots blower

(10 X 2 = 20 MARKS)

Part B

(Each full question carries 20 marks)

Module I

11(a) Derive an expression for angle of swing a vertically hinged plate when the jet of water strikes at its centre

(b) A single jet Pelton wheel runs at 300rpm under a head of 510m. The jet diameter is 200mm and its deflection inside the bucket is 165° and its relative velocity is reduced by 15% due to friction. Assuming a velocity coefficient of 0.98 and speed ratio of 0.46, find i) brake power if mechanical losses are 3% and ii) overall efficiency

OR

12(a) Derive an expression for the specific speed of a turbine

(b) A turbine is to operate under a head of 25m at 200rpm. The discharge is $9\text{m}^3/\text{s}$. If the turbine efficiency is 90%, determine i) specific speed and ii) power generated

Module II

13(a) Derive an expression for minimum speed of a centrifugal pump to commence the flow

(b) A centrifugal pump delivers 1565 liters/s against a mean head of 6.1m when the impeller runs at 200rpm. The impeller diameter is 122cm and the area at outlet periphery is 6450cm^2 . If the vanes are set back at an angle of 26° at the outlet, find i) hydraulic efficiency and ii) power input required

OR

14(a) Sketch and explain the variation of speed on discharge, head and power of a centrifugal pump

(b) A test run on a centrifugal pump indicates that at 2000rpm, it discharges $10\text{m}^3/\text{min}$ against a head of 100m. The input required is 300Kw. If a geometrically similar pump twice the size runs at 1500rpm, find its discharge, head and power for the same efficiency

Module III

15(a) Derive an expression for acceleration head in a reciprocating pump

(b) A single acting reciprocating pump has bore and stroke of 100mm and 250mm respectively. The pump has a suction pipe of 5m height and 200mm diameter. The pump runs at 90rpm and the motion is simple harmonic, find the maximum possible suction lift. Assume that separation occurs at 2m of water absolute. Take atmospheric head as 10.2m of water.

OR

16(a) Show that for a single acting reciprocating pump, the work saved in overcoming friction in the pipe lines by fitting an air vessel is 84.8%

(b) Describe with a neat sketch the working of a hydraulic intensifier

Module IV

17(a) Derive an expression for indicated work of a reciprocating air compressor

(b) A single cylinder single acting reciprocating air compressor has bore and stroke of 20cm and 30cm respectively and the suction conditions are 0.97bar and 27°C . The compressor runs at 600rpm and the delivery pressure is 5.6bar. The clearance ratio is 0.04 and the index of compression and expansion is 1.3, determine (i) FAD, (ii) volumetric efficiency and (iii) indicated power

OR

18(a) Explain the following terms referred to centrifugal compressor

(i) Slip factor and pressure coefficient

(ii) Surging and choking

(b) An axial flow compressor having 10 stages works with 50% degree of reaction. The inlet conditions are 27°C and 100kPa and the pressure ratio is 5. The air enters the compressor with a mean velocity of 110 m/s and the mean speed of the rotor blade is 220 m/s . If the isentropic efficiency of the compressor is 85%, calculate the work input per kg of air and blade angles.