4. Attempt any two of the following: (7×2=14)

(a) How the slow, medium and fast runners of a Francis turbine are specified? A reaction turbine works at 450 rpm under a head of 120m. Its diameter at inlet is 120cm and the flow area is $0.4m^2$. The angles made by the absolute and relative velocities at inlet are 20° and 60° respectively with the tangential velocity. Determine (1) the volume flow rate (2) the hydraulic power developed and (3) the efficiency. Assume whirl at outlet to be zero.

(b) A 4-stroke six cylinder engine has a bore of 80mm and stroke of 100mm. While running at a mean speed of 12.5m/s, its fuel consumption is 20kg/hr. and develops a torgue of 150Nm. Assuming a clearance volume of $75cm^3$ per cylinder, determine (1) brake power and brake mean effective pressure (2) brake thermal efficiency if the calorific value of fuel used is 42.5MJ/kg. (3) relative efficiency on the basis of brake thermal efficiency.

(c) Explain the phenomenon of surging, choking and stalling in rotary compressors.

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Paper Code & Roll No. to be filled in your Answer Book

Roll No. | | | | | | | | | | |

B.Tech.

UTU (Sem. III) (ODD Sem) EXAMINATION, 2013-14

Thermal and Fluid Machines

Time : Two Hours] [Max. Marks : 50

Note: Attempt all questions as per direction given thereof.

All questions carry equal marks. Be precise with your answer.

1. Attempt any four of the following : (3×4=12)

a) Distinguish between a heat engine, a heat hump and a refrigerator.

b) Derive an expression for the thermal efficiency of a Carnot cycle.

c) Explain the process of stream generation (change of phase of water) at constt pressure. Show the various stages on P-V, T-V and T-S diagrams.

d) What is meant by a reheat cycle? When is reheating of stream recommended in a stream power plant?

e) Define compression ratio. How does it affect the air standard efficiency of an Otto cycle?

f) What is cut off ratio? How does it affect the air standard efficiency of a Diesel cycle?

2. Attempt any four of the following : (3×4=12)

(a) What is the principle of operation of a stream turbine? State the fundamental difference between an impulse and a reaction turbine.

(b) Define degree of reaction. Show that with 50% degree of reaction turbine, the fixed and moving blades have the same shape and velocity diagram is symmetrical.

(c) Discuss the influence of reheating, regeneration and intercooling on the performance of a gas turbine cycle.

(d) A Pelton wheel is supplied with water under a head of 45m and at a rate of 48m^3/min. The buckets deflect the jet through 165° and the mean bucket speed is 14m/s. Calculate the power delivered to shaft and overall efficiency of the machine. Assume the coefficient of velocity 0.985 and mechanical efficiency 0.95.

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(e) Which of the Pelton, Francis and Propeller turbines give better off-design performance and why?

(f) Why is the efficiency of Kaplan turbine nearly constt irrespective of speed variation under load?

3. Attempt any two of the following: (6×2=12)

(a) Air enters the compressor of a gas turbine plant operating on Brayton cycle at 1 bar pressure and 300K temp. The pressure ratio is 5 and the maximum cycle temperature is limited to 1075K. If the compressor and turbine efficiencies are 80% and 85% respectively, calculate the net work output, cycle efficiency and the work ratio.

(b) What is meant by governing? Describe briefly the important methods used for the governing of stream turbines.

(c) For a stage of impulse turbine with single acting wheel and equiangular blades, the nozzle angle is 20°. The velocity coefficiency for the blades is 0.83. What is the maximum blade efficiency? If the blade efficiency is 90% of maximum value, what are the possible ratios of blade speed to steam speed?