Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University, Manipal – 576 104

V SEM. B.Tech. (MECHANICAL ENGG.) DEGREE END SEMESTER EXAMINATIONS NOV/DEC 2015

SUBJECT: TURBO MACHINES (MME - 305)

REVISED CREDIT SYSTEM

Time: 3 Hours. MAX.MARKS: 50

Instructions to Candidates:
- Answer **ANY FIVE FULL** questions.

1A	Define specific speed of the turbo machine. From dimensional analysis obtain an expression for the specific speed of the pump and turbine after deriving relevant non-dimensional numbers.	05
1B	The rotational speed of an impulse turbine is 3200 rpm and the mean blade diameter is 0.8 m. The absolute velocity of fluid discharging through a nozzle which is inclined at 20° to the plane of the rotor is 290 m/s. If the utilization factor is 0.82 and relative velocity at the rotor exit is equal to that at the inlet. Find the inlet and exit rotor angles. Also find the power output from the stage for a mass flow rate of 2.1 kg/s and axial thrust on the shaft.	05
2A	With velocity triangles explain the effect of exit blade angles on H-Q performance.	05
2B	An air turbine having 3 stages of equal pressure ratio develops a power of 30 MW. The stage pressure ratio is 2. The overall efficiency is 85 %. The inlet temperature of the turbine is 1600K. Find (i) Stage efficiency (ii) Reheat factor.	05
3A	With the usual notations derive an expression for overall efficiency in terms of stage efficiency, pressure ratio and number stages for an expansion process.	05
3B	A centrifugal pump running at 1200 rpm delivers 225 LPS against a net head of 114 m. The diameter of the impeller is 600 mm. The width of the impeller at exit is 75 mm. The vane angle at exit is 30^o. Assume shockless entry at inlet	05

with constant radial flow velocity. Compute (i) Manometric efficiency (ii) Static pressure rise across the impeller assuming hydraulic loss over it as 10% of exit velocity head (iii) Pressure rise through the volute (iv) Power input, if the overall efficiency is 60%.

4A Explain slip in centrifugal compressor with suitable sketch. Using Stodola theory, find the relation between number of vanes and slip factor. 05

4B A Multi stage axial flow compressor is to have constant axial velocity of 150 m/s and 50 % reaction. The pressure ratio developed is 4 and infinitesimal polytropic efficiency is 85%. The temperature at entry is 20° C. The mean diameter of the blade ring is 350 mm and speed is 15000 RPM. The exit angle of the blade row in each row is 27° with respect to axial direction. Calculate the blade angle at inlet, the number of stages and the pressure ratio of each stage. 05

5A What is the importance of compounding of steam turbines? Explain with neat sketches velocity compounding and pressure compounding. 05

5B A pelton turbine produces 15 MW under a head of 300 m, the turbine speed being 500 rpm. Assuming turbine efficiency of 84%, coefficient of jet as 0.97, blade speed ratio of 0.46, bucket coefficient of 0.85, jet ratio of 9.5, and assuming the deflection angle of the jet over the bucket as 165°, compute the number of jets required, the diameter of each jet and tangential force exerted by each jet on the bucket. 05

6A With a neat sketch explain governing of Pelton turbine. 05

6B Steam in two row velocity compounded Impulse Turbine leaves the nozzle at 600 m/s and the blade speed is 120 m/s. Before leaving the first stage it passes through a ring of moving blades, a ring of fixed stator blades followed by another set of moving rotor blades. The nozzle angle is 16^{o}. The exit blade angles are 18^{o} for the first row of moving blades and 21^{o} for the stator blades and 35^{o} for the second row of moving blades. Assuming 10% drop in velocity during the passage through each blade find (i) Inlet blade angle (ii) driving force and axial thrust for each row (iii) Total power developed per unit mass flow rate. 05