Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

V SEMESTER B.TECH. (MECHANICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: TURBO MACHINES [MME 3101]

REVISED CREDIT SYSTEM
(29 /11/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A.	Derive and show that for a radial tip impeller of an air compressor degree of reaction $R=\frac{1-\phi_2^2}{2}$ where ϕ is the flow coefficient of the compressor.	**05**
1B.	In a three stage turbine, the pressure ratio of each stage is 2 and the stage efficiency is 75%. Calculate the overall efficiency and the power developed if air initially at a temperature of 600°C flows through it at the rate of 25kg/s. Also find reheat factor.	**05**
2A.	Deduce an expression for mass and speed parameters from dimensional analysis of a compressible flow turbo machine.	**05**
2B.	A centrifugal pump is running at 1000 rpm, with outer vane angle of 45^0. Flow velocity at outlet is 2.5 m/s. It gives a discharge of 200 liters per second against a head of 20 m. The manometric efficiency is 80%. Determine impeller tip diameter and impeller exit width.	**05**
3A.	With the help of velocity diagrams explain the effect of exit blade angle on the H-Q performance of a pump.	**05**
3B.	In an inward flow reaction turbine water enters the turbine such that the inlet nozzle angle is 25° and blade angle is 105°. The meridional component of velocity is constant throughout. If exit of water is radial what is the utilization factor and degree of reaction. Determine work done /kg by the turbine if the available head on the turbine is 5 meters.	**05**

4A.	For a Pelton wheel show that utilization factor is given by, $\varepsilon = \phi(1-\phi)(1+\cos\beta_2)$, where ϕ is the speed ratio. Hence derive an expression for maximum utilization factor.	**05**
4B.	Nozzle of a single stage impulse turbine are inclined at 20^0 and steam leaves the nozzle at 375 m/s. The blade speed is 165 m/s. Find suitable inlet and outlet blade angles so that there is no axial thrust on the blades. Velocity of the steam over the blades is reduced by 15 %. Find power developed per unit mass flow rate and utilization factor	**05**
5A.	Obtain the expression for overall efficiency of turbine in terms of polytropic efficiency and pressure ratio.	**05**
5B.	A Francis Turbine develops 475 kW at an overall efficiency of 85%, when working under a static head of 5m. The draft tube being cylindrical and is 2m in diameter. What increase in power and efficiency can be expected with the head, speed and discharge remaining same, a tapered draft tube having an outlet diameter of 3.5 m and efficiency of conversion of 90% is substituted for the cylindrical one.	**05**