BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP2023)

CLASS: BTECH **SEMESTER :**
BRANCH: MECHANICAL **SESSION : SP2023**

SUBJECT: ME349 TURBO MACHINERY

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Show that the discharge of a centrifugal pump is given by $Q = ND^3 \ \mathrm{f}\left[\frac{gH}{N^2D^2}, \frac{\mu}{ND^2\rho}\right]$ where *N* is the speed of the pump in rpm, *D is* the diameter of the impeller, *g is* the acceleration due to gravity, *H* is the manometric head, *μ* is the viscosity of the fluid and ρ is the density of the fluid.	[5]	CO2	2
Q.2(a)	What is the significance of the specific speed of the turbine and pump?	[2]	CO1	1
Q.2(b)	An axial flow pump with a rotor diameter of 30 cm handles liquid water at the rate of 2.7 m^3/min while operating at 1500 rpm. The corresponding energy input is 125 J/kg. The total-to-total efficiency is 75%. If a second geometrically similar pump with a diameter of 20 cm operates at 3000 rpm, find (a) its flow rate, (b) power input and (c) change in total pressure.	[3]	CO4	3
Q.3(a)	Explain the working principle of the reaction turbine with pressure and velocity variation across the turbine.	[2]	CO1	2
Q.3(b)	Air flows through the rotor of a power-absorbing machine at a mean radius of 20 cm. If the tangential component of velocity increases by +20 m/s, calculate (a) the torque exerted on air for a flow rate of 118.92 kg/s. (b) Find the power input in kW if the machine rotates at 2400 rpm.	[3]	CO3	3
Q.4(a)	Explain the pressure compounding in an impulse turbine with velocity and pressure variation across the nozzle, moving and fixed blades.	[3]	CO2	2
Q.4(b)	What are the advantages and disadvantages of velocity compounding?	[2]	CO1	1
Q.5	In a stage of an impulse turbine provided with a single-row wheel, the mean diameter of the blade ring is 80 cm and the speed of rotation is 3000 rpm. The steam issues from the nozzles with a velocity of 300 m/s and the nozzle angle is 20°. The rotor blades are equiangular and the blade velocity coefficient is 0.85. What is the power developed in the blades?	[5]	CO3	3

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