Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2020

Course: Fluid Machinery **Semester: VI**
Program: B. Tech. Mechanical Engineering **Time: as per instruction**
Course Code: MECH 3009 **Max. Marks: 100**

Instructions:

1. **Read the questions carefully. Some numerical values of questions 2, 3, 4, 5, and 6 are coded with your SAP id/Roll number.**
2. **Section A** will be conducted online on BB Collaborate platform
3. The maximum time allocated to **Section A** is one Hrs.
4. **Section B** to be submitted within 24 hrs from the scheduled time (*exceptional provision due extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas***)**.
5. No submission of **Section B** shall be entertained after 24 Hrs.
6. **Section B** should be attempted after **Section A**
7. **The section B** should be attempted in blank white sheets (hand written) with all the details like programme, semester, course name, course code, name of the student, Sapid at the top (as in the format) and signature at the bottom (right hand side bottom corner)

SECTION A

S. No.		**Marks**	**CO**
Q 1	Multi choice questions. Tick the correct answer.	**25**	**CO1**
1.1	The mass of an object is 10 kg. The gravitational acceleration at a location is 5 m/s^2. The specific weight is a) 2N b) 15N c) 5N d) 50N		
1.2	A high specific speed Francis turbine is a) Radial flow turbine b) Tangential flow turbine c) Mixed flow turbine d) Axial flow turbine		
1.3	Flow ratio is a) Flow velocity / blade velocity b) Flow velocity / Relative velocity		

	c) Flow velocity / (2g H)^½ d) Flow velocity /whirl velocity		
1.4	The manometric efficiency of a centrifugal pump is given by a) u2 Vu2/g b) 2H/u2 Vu2 c) gH/u2 Vu2 d) u2 Vu2/gH.		
1.5	Cavitation damage in turbine runner occurs near the a) inlet on the convex side of blades b) outlet on the convex side of blades c) inlet on the concave side of blade d) outlet on the concave side of blade		
1.6	An impulse turbine requires a) high head and small quantity of flow b) low head and small quantity of flow c) low had and hish rate of flow d) none of the above		
1.7	With reference to a centrifugal pump which of the following statement is incorrect a) the discharge control valve is fitted in the delivery pipe b) the suction pipe is provided with a foot valve and a strainer c) the suction pipe has larger diameter as compared to the discharge pipe d) the discharge control valve is fitted in the suction pipe		
1.8	The delivery valve, while starting centrifugal pump, is kept a) fully closed b) fully open c) half open d) in any position		
1.9	The ratio of power outlet of the pump to the power input to the pump is known as a) mechanical efficiency b) overall efficiency c) manometric efficiency d) none of the above		
1.10	Which of the following is not a dimensionless parameter a) friction factor b) specific speed c) Thoma's cavitation parameter d) pressure coeffient		
1.11	Vaneless diffusers are suitable for a) only low pressure rise		

	b) only high pressure rise c) both low as well as high pressure rise d) none of the above		
1.12	What is the ratio of isentropic work to Euler work in a centrifugal compressor called? a) Work coefficient b) Velocity coefficient c) Pressure coefficient d) Flow coefficient		
1.13	A gas turbine works on a) Rankine cycle b) Brayton cycle c) Otto cycle d) Diesel cycle		
1.14	Reciprocating air compressor are suitable for a) high dischare rate and high pressure b) low discharge rate and high pressure c) low discharge rate and low pressure d) high discharge and low pressure		
1.15	In an axial flow compressor, the ratio of pressure in the rotor blades to the pressure rise in the compressor in one stage is known as.. a) Degree of reaction b) slip factor c) work factor d) pressure coefficient		
1.16	The ratio of the volume of free air delivery per stroke to the swept volume of the piston,is known as a) isentropic efficiency b) volumetric efficiency c) mechanical efficiency d) manometric efficiency		
1.17	Which of the following turbine is suitable for specific speed ranging from 300 to 1000 and head below 30m. a) Francis b) Kaplan c) Propeller d) Pelton		
1.18	In a reaction turbine the function of a draft tube is to a) provide safety to turbine b) prevent air from entering		

	c) reconvert the kinetic to flow energy d) increase the rate of flow		
1.19	The power which appears in the expression for the specific speed is a) shaft power b) water power c) power into the turbine d) none of the above e)		
1.20	A centrifugal pump is taking much of power, the probable reason may be a) liquid being pumped is heavy b) speed of the pump is low c) there is leakage of air d) ineffective strainer and foot valve arrangement		
1.21	Multistaging (series) of compressor is done a) to increase the pressure ratio b) to decrease the pressure ratio c) neither increase nor decrease the pressure ratio d) none of the above		
1.22	The power range of micro gas turbine is a) 0.5-2.5MW b) 20kW-350kW c) 500MW-5000MW d) none of the above		
1.23	Reciprocating air compressor is a— a) positive displacement compressor b) rotodymanic compressor c) rotory compressor d) Ejector		
1.24	The main benefit of the using intercooler in multi-staging of compressor a) to save power required to drive compressor b) increase the volumetric efficiency c) both a and b d) none of the above		
1.25	The performance of the gas turbine can be improved by a) incorporating the regenerator b) incorporating the reheater c) both a and b d) can't say		
SECTION B			

Q2	The impeller of a centrifugal pump having external and internal diameters 500mm and 250mm respectively, width at outlet 50mm and running at speed of **last three digit of your SAP id rpm** works against a head of 48m. The velocity of flow through the impeller is constant and equal to 3m/s. the vanes are set back at an angle of 40^0 at outlet. Determine; a. Inlet vane angle b. Workdone by the impeller on water per second, and c. Manometric efficiency.	**15**	**CO3**
Q3	It is desired to generate 1000 kW of power and survey reveals that 450m of static head and minimum flow of $0.3m^3/s$ is available. Comment whether the task can be accomplished by installing a Pelton wheel that turns **last three digit of your SAP id rpm** and has efficiency of 80%. Further design the Pelton wheel by assuming suitable data for coefficient of velocity, speed ratio, and velocity coefficient for the jet.	**15**	**CO2**
Q4	A single stage double acting air compressor delivers 15 m^3/min. measured at 1.013 bar and temperature 27^0C and delivers at 7 bar. The conditions at the end of the suction stroke are pressure 0.98 bar and temperature 40^0C. The clearance volume is 4% of the swept volume and the stroke / bore ratio is 1.3/1, compressor runs at **last three digit of your SAP id rpm**. Calculate the volumetric efficiency, cylinder dimensions, indicated power and isothermal efficiency of this compressor. Take the index of compression and expansion as 1.3, R= 0.587kJ/Kg-K.	**15**	**CO4**
Q5	A turbine is to operate under a head of 25m at the speed of **last three digit of your SAP id rpm**. The discharge is $9m^3/s$. if the efficiency is 90% determine the performance of turbine under a head of 20m.	**15**	**CO2**
Q6	A closed cycle gas turbine consists of a two stage compressor and a two stage turbine. All the components are mounted on the same shaft. The pressure and temperature at the inlet of the first stage compressor are 2 bar and 25^0C. The maximum cycle temperature and pressure are limited to 850^0C and 8 bar. A perfect intercooler is used between the two compressors and a reheater is used between the two turbines. Gases are heated in the reheater to 850^0C before entering into the L.P. turbine. Assuming the compressor and turbine efficiencies as 0.83 find (a) the cycle efficiency without regenerator, (b) with regenerator whose effectiveness is 0.65 and (c) if the I.P. developed by the plant is 310kW. Find the mass of the fluid circulated. Air is used in the cycle as working fluid γ=1.4 and Cp=1kJ/Kg-K.	**15**	**CO4**