COLEGE OF ENGINEERING, PUNE
(Autonomous Institute of Govt. of Maharashtra)
END SEMESTER EXAM

Subject: **Mechanical Technology (ME213)** *Dept*: **Metallurgy and Material Science**
Year: S.Y.B.Tech *Date*:27 /11/2011
Time: **3 hrs** *Max Marks*: **50**

Instructions:

- Use of scientific calculators is permitted.
- All questions are compulsory.
- Assume suitable data wherever necessary.

Q1 The following observations were made during the trial of single cylinder 4 stroke gas engine having cylinder diameter of 18 cm and stroke 24cm **5**

Duration of trial	30min
Total number of revolutions	9000
Total number of explosions	4450
Mean effective pressure	5 bar
Net load on brake wheel	40kg
Effective diameter of brake wheel	1m
Total gas used at NTP	$2.4m^3$
C_v	$19MJ/ m^3$
Total air used	$36 m^3$
Pressure of air	720mm of Hg
Temperature of air	17^0C
Density of air at NTP	$1.29kg/m^3$
Temperature of exhaust gas	350^0C
Room temperature	17^0C
Specific heat of exhaust gas	1kJ/kgK
Cooling water circulated	80kg
Rise in temperature of cooling water	30^0C

Draw heat balance sheet and estimate the mechanical and indicated thermal efficiency of engine. Take R=287 J/kgK.

Q2 a) A Parson's reaction turbine, while running at 400 rpm consumes 30 tons of steam/hr. the steam at a certain stage is at 1.6 bars with dryness fraction of 0.9 (Take $V_g=1.091m^3/kg$) & the stage develops 10 kW. The axial velocity of flow is constant and equal to 0.75 times the blade velocity. Find mean diameter of the drum and the volume of steam flowing per second. Take blade tip angles at inlet and exit as 35^0 and 20^0 respectively. **5**

OR

a) The nozzles of a De-laval Turbine deliver 1.5kg/s of steam at a speed of 800m/s to a ring of moving blades having a speed of 200m/s. the exit angle of nozzle is 18^0. If the blade velocity coefficient is 0.75 and the exit angle of moving blades is 25^0. Calculate **5**

i. Inlet angle of moving and fixed blades
ii. Diagram efficiency
iii. Energy lost in blades/sec.
iv. Power developed
v. Axial thrust on thrust on turbine rotor.

b) Explain with neat figure Impulse steam turbine. Discuss the terms pressure, velocity compounding along with figure. **4**

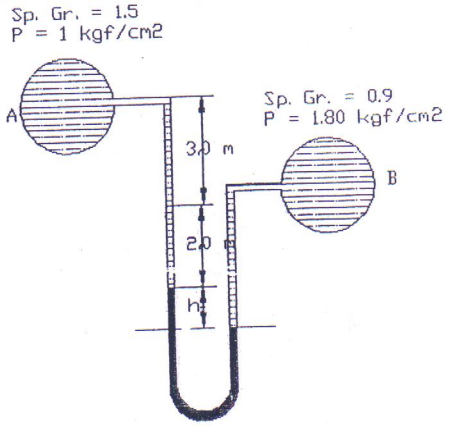
Q3 a) Draw self explanatory sketches for venturimeter, differential U tube manometer, **3**

pitot tube.

b) Draw self explanatory sketches of various types of Heat exchangers. 3

c) Explain vacuum pressure, Absolute pressure, Gauge pressure with the help of neat sketch. 2

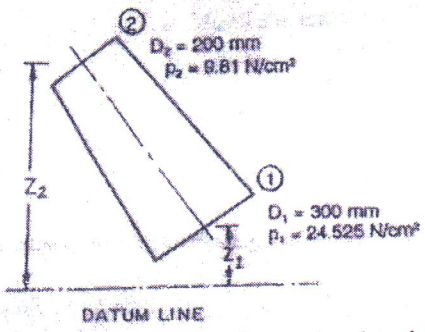
Q4 a) A differential manometer is connected at the two points A and B of two pipes as shown in Fig. the pipe A contains a liquid of specific gravity 1.5 while pipe B contains a liquid of specific gravity 0.9. The pressures at A and B are 1 kgf/cm^2 and 1.80 kgf/cm^2 respectively. Find the difference in mercury level in the differential manometer. 4



OR

a) A horizontal venturimeter with inlet and throat diameter 25cm and 13cm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 18 cm of mercury. Determine the rate of flow Take $C_d = 0.98$. 4

b) Water is flowing through a pipe having diameter 300mm and 200mm at the bottom and the upper end respectivcly. The intensity of pressure at bottom end is 24.525N/cm^2 and the pressure at the upper end is 9.81N/cm^2. Determine the difference in datum end if the rate of flow through the pipe is 40liters/sec. 4



Q5 a) Explain with neat sketch the working of Pelton wheel turbine. 3

b) Explain with neat sketch the working of centrifugal pump. 3

c) Discuss in detail the classification of Hydraulic turbines. State the function and importance of draft tube in Reaction turbines. 4

Q6 a) Define 4

i) Thermal conductivity

ii) Thermal resistance

iii) Overall heat transfer coefficient

iv) Newton's law of cooling

b) A furnace wall is made up of 3 layers of thickness 200, 150 and 175mm with thermal conductivities of 1.56, K and 1.3 W/m^{0}C. If the inner side of the furnace is exposed to gas at 1300^{0}C with a convection coefficient of 22 W/m^2 ^{0}C and the inner side surface is at 1150^{0}C. The outside surface is exposed to air at 27^{0}C with convection of 11 W/m^2 ^{0}C. Determine 6

i. the unknown thermal conductivity k
ii. the overall heat transfer coefficient
iii. all surface temperatures

OR

b) A hot gas at 300^{0}C flows through a long metal pipe 10 cm OD and 3mm thick. From the standpoint of safety and energy conservation mineral wool insulation (k = 0.052W/mK) is wrapped around it so that the exposed surface of insulation is at temperature of 50^{0}C. Calculate the thickness of insulation required to achieve this temperature if h_i = 29W/m^{2}K and h_o = 12W/m^{2}K and surrounding air temperature is 25^{0}C. Also calculate the corresponding heat loss rate/ unit length. 6