GYANMANJARI INSTITUTE OF TECHNOLOGY (GMIT)

MECHANICAL ENGINEERING DEPARTMENT

QUESTION BANK

SUBJECT CODE: **2140907** SUBJECT: **APPLIED THERMAL & HYDEAULIC ENGINEERING**

Sr. No.	Detail	Year	Mark
	UNIT 1 Steam power Cycle		
1.	Explain any one method of improving thermal efficiency of Rankine cycle in detail.	Nov-2016	3
2.	How the subject "ATHE" is related to electrical engineering branch.	Nov-2016	4
3.	With neat sketch explain Rankine cycle for thermal power plant. Plot the same cycle on T-s and h-s diagram also	Dec-2015 May-2015	7 7
4.	When does the reheating of steam become necessary? Explain the effect of reheat on cycle output and efficiency.	May-2016	04
5.	A steam turbine plant equipped with a regenerative feed heater operates under the following conditions: Initial steam pressure = 20 bar, Extraction pressure = 4 bar Initial super heat = 100oC, Exhaust pressure = 0.05 bar Neglecting pump work, compare the regenerative and non-regenerative cycle with respect to the following: (i) thermal efficiency, and (ii) steam consumption in kg/kWh	May-2016	7
6.	Determine Rankine cycle efficiency for a cycle working between pressure limits of 35 bar and 0.30 bar when steam is dry and saturated considering pump work	Nov-2016	7
	UNIT 2 Gas power Cycles		
1.	Plot schematic diagram, p-v and T-s diagram for open cycle gas turbine power plant.	Nov-2016	3
2.	Enlist the different methods of improving efficiency of Brayton cycle and explain any one in detail.	Nov-2016	4
3.	Differentiate between open cycle and closed cycle gas turbine power plant. Plot schematic diagram, p-v and T-s diagram for open cycle gas turbine power plant.	Dec-2015	7
4.	Differentiate between Rankine cycle and Brayton cycle	Dec-2015	3
5.	Give comparison between open cycle and closed cycle gas turbines.	May-2016	3
6.	Explain with schematic diagram open cycle gas turbine with regeneration.	May-2016	4
7.	The air enters the compressor of an open cycle constant pressure gas turbine at a pressure of 1 bar and temperature 25oC. The pressure of air after compression is 5 bar. The isentropic efficiencies of compressor and turbine are 85%. The air fuel ratio used as 90:1, the flow rate of air is 3 kg/s. Find: (i) power developed, and (ii) thermal efficiency of cycle. Assume: Cp = 1.005 kJ/kg and $\gamma = 1.4$ for air and gas, and Calorific value of fuel = 41,800 kJ/kg.	May-2016	7
8.	A closed cycle gas turbine in which air enters compressor at 1 bar, 300C, with pressure ratio in cycle at 5. Calculate the cycle efficiency. If it is heated in the combustion chamber to maximum temperature of 7100C. Take $\gamma = 1.4$ and Cp= 1.005 kJ/kg.	May-2015	7
	UNIT 3 Refrigeration Cycles		
1.	Draw the neat and labeled sketch of vapour compression refrigeration cycle with T-	Nov-2016	4

<table>
<tr><th>Sr. No.</th><th>Detail</th><th>Year</th><th>Mark</th></tr>
<tr><td></td><td>S and P-h diagram.</td><td></td><td></td></tr>
<tr><td>2.</td><td>Explain the working of a simple air cooling system used for aircraft.</td><td>Nov-2016</td><td>7</td></tr>
<tr><td>3.</td><td>With neat sketch explain simple vapor compression refrigeration (VCR) cycle. Plot the same cycle on T-s and p-h diagram also.</td><td>Dec-2015
May-2015</td><td>7
7</td></tr>
<tr><td>4.</td><td>Explain the working of a simple air cooling system used for aircraft.</td><td>May-2015</td><td>7</td></tr>
<tr><td>5.</td><td>An R-134a vapour compression system has saturated suction temperature of 0^{o}C, and saturated discharge temperature is 40o C. The refrigerant vapour is dry saturated at the suction of compressor and becomes superheated after the compression. For one ton of refrigeration capacity, calculate (i) refrigerating effect, (ii) mass flow rate, (iii) power required, (iv) COP of the system.
Use following properties of R-134a:
<table>
<tr><th rowspan="2">Saturation temperature ^{o}C</th><th colspan="2">Specific enthalpy kJ/kg</th><th colspan="2">Specific entropy kJ/kg K</th><th colspan="2">Specific heat kJ/kg K</th></tr>
<tr><th>Liquid</th><th>Vapour</th><th>Liquid</th><th>Vapour</th><th>Liquid</th><th>Vapour</th></tr>
<tr><td>40</td><td>256.41</td><td>419.43</td><td>1.1905</td><td>1.7111</td><td>1.498</td><td>1.145</td></tr>
<tr><td>0</td><td>200.00</td><td>398.6</td><td>1.000</td><td>1.7271</td><td>1.341</td><td>0.897</td></tr>
</table></td><td>May-2016</td><td>7</td></tr>
<tr><td></td><td colspan="2">UNIT 4 Heat Transfer</td><td></td></tr>
<tr><td>1.</td><td>Explain in brief about various modes of heat transfer</td><td>Nov-2016
Dec-2015</td><td>3
7</td></tr>
<tr><td>2.</td><td>Explain in brief about thermal contact resistance</td><td>Nov-2016</td><td>4</td></tr>
<tr><td>3.</td><td>Explain the concept of overall heat transfer coefficient.</td><td>Nov-2016</td><td>4</td></tr>
<tr><td>4.</td><td>What do you mean by overall heat transfer coefficient?</td><td>May-2015</td><td>3</td></tr>
<tr><td>5.</td><td>In what way knowledge of heat transfer is useful in your field of engineering?</td><td>Dec-2015</td><td>3</td></tr>
<tr><td>6.</td><td>Write the most general equation in Cartesian coordinate system and in the cylindrical coordinates system for heat transfer by conduction.</td><td>Dec-2015</td><td>4</td></tr>
<tr><td>7.</td><td>Derive an expression for steady state heat conduction through hollow cylinder.</td><td>May-2016</td><td>7</td></tr>
<tr><td>8.</td><td>Derive expressions for temperature distribution, under one dimensional steady state heat conduction for the slab</td><td>May-2015</td><td>7</td></tr>
<tr><td>9.</td><td>Differentiate between Conduction and convection</td><td>Dec-2015</td><td>3</td></tr>
<tr><td>10.</td><td>Explain convective heat transfer co-efficient. Also explain natural and forced convection</td><td>May-2015</td><td>7</td></tr>
<tr><td>11.</td><td>Define the thermal conductivity and explain critical thickness of insulation.</td><td>May-2015</td><td>7</td></tr>
<tr><td>12.</td><td>What is the function of fins in heat transfer? State applications of fins</td><td>May-2016</td><td>3</td></tr>
<tr><td>13.</td><td>What is black body? Explain kirchhoff’s law in detail.</td><td>May-2015</td><td>7</td></tr>
<tr><td>14.</td><td>A 3 mm diameter and 5 m long electric wire is tightly wrapped with a 2 mm thick plastic cover (thermal conductivity is k = 0.15 W/m • °C.). Electrical measurements indicate that a current of 10 A passes through the wire and there is a voltage drop of 8 V along the wire. If the insulated wire is exposed to a medium at T∞ = 30 °C with a heat transfer coefficient of h = 12 W/m2 • °C, determine the temperature at the interface of the wire and the plastic cover in steady operation. Also determine whether doubling the thickness of the plastic cover will increase or</td><td>Nov-2016</td><td>7</td></tr>
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	decrease this interface temperature.		
	UNIT 5 Heat Exchangers		
1.	Derive the equation for logarithmic mean temperature difference for single pass counter flow heat exchanger.	Nov-2016	7
2.	Differentiate between Parallel flow heat exchanger and counter flow heat exchanger.	May-2015	4
3.	Plot the temperature distribution along the length of following heat exchangers: (i) parallel flow, (ii) counter flow, (iii) evaporator, and (iv) condenser.	May-2016	4
4.	Flow rates of hot and cold water streams running through a parallel flow heat exchanger are 0.25 kg/s and 0.6 kg/s respectively. The inlet temperatures on the hot and cold sides are 80oC and 25oC respectively. The exit temperature of hot water is 45oC. If the individual heat transfer coefficients on both sides are 600 W/m2 ^{o}C, calculate the area of the heat exchanger.	May-2016	7
	UNIT 6 Fluid Mechanics		
1.	Define (1) Surface Tension, (2) capillarity, (3) gauge pressure and (4) fluid.	Nov-2016	4
2.	Explain the following terms: (i) Viscosity (ii) Capillary tube (iii) Surface tension	May-2015	7
3.	Define the terms: (i) Viscosity, (ii) Cohesion and adhesion, and (iii) Surface tension	May-2016	3
4.	Define the following; 1) density,2) viscosity, 3) surface tension, 4) capillarity, 5) gauge pressure, 6) absolute pressure, 7) fluid.	Dec-2015	7
5.	Sate and prove Hydrostatic law.	May-2016	3
6.	Enlist various devices used to measure pressure of the fluid. With neat sketch explain working and construction of Bourdon tube pressure gauge	Dec-2015	7
7.	What is Manometer? Explain bourdon tube pressure gauge with a neat sketch.	May-2015	7
8.	Explain fully the micro-manometers.	May-2016	4
	UNIT 7 Fluid Dynamics		
1.	State Bernoulli's equation and write assumptions and applications of Bernoulli's equation.	Nov-2016 Dec-2015	7 7
2.	Give broad classification of notches and weirs	Nov-2016 Dec-2015	3 7
3.	What is notch? Derive an expression for discharge over a rectangular notch.	May-2016	4
4.	What are the applications of Pitot tube? With neat sketch, explain working of Pitot tube.	Dec-2015	5
5.	Derive the equation to measure the quantity of water flowing through a venturimeter	Nov-2016	3
6.	With neat sketch, explain working of venturimeter for flow measurement.	Dec-2015	5
7.	What is Euler's equation of motion? Derive Euler's momentum equation.	May-2015	7
8.	Explain the principle of venturimeter with neat sketch? Derive an expression for the discharge for the rate of flow of fluid through it.	May-2015	7
9.	A pipe is having diameters 40 cm and 20 cm at the cross sections 1 and 2 respectively through which water is flowing. The velocity of water at section 1 is 5 m/s. Determine the velocity head at section 1 and 2, and also flow rate	May-2016	7

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10.	A rectangular notch has a discharge of 20 m3/min, when the head of water is half the length (width) of notch. Find the length of notch. Assume coefficient of discharge = 0.60	Nov-2016	7
	UNIT 8 Centrifugal Pump		
1.	Explain different efficiencies related to centrifugal pump.	Nov-2016	3
2.	Explain cavitation in detail.	Nov-2016 May-2015	3 7
3.	Write short note on classification of centrifugal pump	Nov-2016	4
4.	Define the following; 1) cavitation, 2)NPSH, 3) specific speed, 4) priming of pump.	Dec-2015	8
5.	What are the applications of centrifugal pump? Draw neat sketch of centrifugal pump and indicate main parts and various heads also for above pump.	Dec-2015	6
6.	Differentiate between Axial flow pump and centrifugal flow pump	Dec-2015	3
7.	Obtain an expression for the work done by the impeller of a centrifugal pump on water per second per unit weight of water.	May-2015	7
8.	Plot the main characteristics curves for centrifugal pump.	May-2016	3
9.	What is specific speed of centrifugal pump? Derive an expression of specific speed of centrifugal pump.	May-2016	4
	UNIT 9 Reciprocating Pumps		
1.	Differentiate between Reciprocating pump and rotary pump.	Dec-2015	3
	UNIT 10 Hydraulic Turbine		
1.	Classify Francis Turbine. With neat sketch explain working and construction of Francis Turbine	Nov-2016 Dec-2015	7 8
2.	Classify Pelton turbine. With neat sketch explain working and construction of Pelton Turbine	Dec-2015	6
3.	Explain performance characteristics curves of hydraulic turbines.	May-2016	7
4.	Differentiate between Hydraulic pump and hydraulic turbine	Dec-2015	3
5.	Differentiate between Impulse turbine and reaction turbine	Dec-2015 May-2016	3 3
6.	Differentiate between Francis and Kaplan turbines.	May-2016	3
7.	With a neat sketch, explain the working principle of a Pelton wheel.	May-2015	7
8.	Explain draft tube and its importance.	May-2016	4
9.	A jet strikes the buckets of a pelton wheel, which is having shaft power as 7000 kW. The diameter of jet is 200 mm. If the net head on the turbine is 400 m, find the overall efficiency of the turbine. Take Cv = 1.0.	May-2015	7
10.	A hydraulic turbine is to operate under a head of 20 m at 140 rpm. The discharge is 5 m3/sec. If efficiency of turbine is 85 %, determine (1) power generated by the turbine, (2) specific speed of turbine and (3) type of turbine.	Nov-2016	7
11.	Francis turbine is designed to develop 150 kW, working under a head of 10 m and running at 200 rpm. The hydraulic losses in turbine are 15% of available energy. The overall efficiency of turbine is 80%. Assume: flow ratio = 0.94 and speed ratio	May-2016	7

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	= 0.25. Calculate: (i) the guide blade angle and runner vane angle at inlet, (ii) runner diameter and width at inlet		