THERMAL ENGINEERING -II Unit Wise Important Questions

1. Group - A (Short Answer Questions)

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	Unit – I		
1	(a) Explain working principle of Rankine cycle? (b) In a Rankine cycle, the steam at inlet to Turbine is saturated at a pressure of 35bar and the exhaust pressure is 0.2bar. Determine i)the pump work ii) Turbine work iii) Rankine efficiency iv) Condenser heat flow v) the dryness at the end of expansion. Assume flow rate of 9.5kg/sec	Application, Synthesis	1
2	(a) Explain the Regenerative cycle in detail with a neat sketch (b) A Steam Turbine is fed with steam having an enthalpy of 3100kJ/Kg. It moves out of Turbine with an enthalpy of 2100KJ/Kg. Feed heating is done at a pressure of 3.2bar, with steam enthalpy of 2500KJ/kg. The condensate from a condenser with an enthalpy of 125KJ/kg enters into the feed heater. The quantity of bled steam is 11200Kg/hour. Find the power developed by the Turbine. Assume that the water leaving the feed heater is saturated liquid at 3.2bar and the heater is direct mixing type. Neglect pump work. Show the arrangements in figure	Application	1
3	a)Classify and explain the classification of fuels. (b) Explain Adiabatic flame temperature.	Application	1

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	© A simple Rankine cycle works between pressures 28bar and 0.06bar. The initial condition of steam is dry saturated. Calculate cycle efficiency, work ratio and specific steam consumption		
4	(a) How do you analyses the exhaust and flue gases by using Orsat's apparatus. Explain with neat diagram. (b). In a steam power cycle, the steam supply is at 15bar and dry and saturated. The condenser pressure is 0.4bar. Calculate the Carnot and Rankine efficiency of the cycles. Neglect pump work.	Comprehension, Application	1
5	a) How can you convert weight analysis in volumetric analysis? Super heated steam at a pressure of 10bar and 400^0C is supplied to a eam engine. Adiabatic expansion takes place to release point at 0.9bar d it exhaust s into a condenser at 0.3bar. Neglecting clearance, termine for a steam flow rate of 1.5kg/sec. i) quality of steam at e end of expansion and the end of constant volume operation ii) wer developed iii) specific steam consumption iv) modified ankine cycle efficiency	Application	1
6	a). What is meant by stoichiometric Air fuel ratio b)Steam is supplied to a Turbine at a pressure of 30bar and at a temperature of 400^0C and is expanded adiabatically to a pressure of 0.04bar. At a stage of Turbine, where the pressure is 3bar, a connection is made to a surface heater in which the feed water is heated by bled steam to a temperature of 130^0C. The condensed steam from the feed water is cooled in a drain cooler to 27^0C. The feed water passes through the drain cooler before entering the feed heater. The cooled drain water combines with the condensate in the well of condenser. Assuming no heat losses in the steam. Calculate i) mass of steam used for feed heating per kg of steam entering the Turbine ii) Thermal efficiency of cycle.	Comprehension, Application	1
7	a). What are the advantages and disadvantages of regenerative cycle over simple Rankine Cycle? b). The percentage composition of sample of liquid fuel by weight is, C=84.8% and H_2=15.2%. Calculate i)the weight of air needed for the combustion of 1kg of fuel ii) the volumetric compositon of product of combustion if 15% excess air is supplied	Comprehension, Application	1
8	a). Explain the Reheating cycle in detail with a neat sketch b) The following is the ultimate analysis of a sample of petrol by weight: Carbon =85%, Hydrogen=15%.Calculate the ratio of air to petrol consumption by weight if the volumetric analysis of dry exhaust gas is CO_2=11.5%, CO=1.2%,O_2=0.9% and N_2=86%. Also find percentage excess air.	Comprehension, Application	1
9	a). Explain the advantages and disadvantages of Reheating? b) Determine the gravimetric analysis of the products of complete combustion of acetylene with 200% stoichiometric air	Application, Synthesys	1
10	a). Compare Rankine cycle and carnot cycle? b) The percentage composition of sample of liquid fuel by weight is, C=84.8% and H_2=15.2%. Calculate i)the weight of air needed for the combustion of 1kg of fuel ii) the volumetric compositon of product of combustion if 15% excess air is supplied	Comprehension, Application	1
	UNIT – II		
1	a) State the differences between the following boilers? i) Externally fired and internally fired boilers.	Comprehension,	3

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	ii)Forced circulation and natural circulation b) State the differences between the High Pressure and low Pressure boilers?	Evaluation	
2	(a) Explain with the help of neat diagrams, Cochran boiler fire tube boilers (b) Explain with the help of neat diagrams Lancashire boiler	Evaluation, Application	3
3	a) Explain the following boiler terms : Shell, setting, grate, furnace, water space and steam space b) EXPLAIN the terms mountings, accessories, water level, blowing off, lagging refractory.	Comprehension, Application	3
4	a). Give the construction and working of the Babcock and Wilcox water tube boilers? b) Explain with neat sketchs, the construction and working of the La Mont boiler and Bension boiler	Evaluation , Application	3
5	a) Explain with neat sketches any three of the following mountings? i)water level indicator ii) Pressure gauge iii)Feed check valve b) i)Blow-off cock ii)High steam and low water safety valve	Application	3
6	(a) Explain the concept of discharge through the nozzle (b).classify nozzles. c) Dry saturated steam enters a steam nozzle at a pressure of 15 bar and is discharged at a pressure of 2.0 bar. If the dryness fraction of discharge steam is 0.96.what will be the final velocity of steam? Neglecting initial velocity of steam	Analysis, Application	3
7	(a) Derive the conditions for discharge and its maximum value of a nozzle. (b). The nozzles of a Delaval turbine are supplied with dry saturated steam at a pressure of 9 bar. The pressure at the outlet is 1 bar. The turbine has two nozzles with a throat diameter of 2.5 mm. Assuming nozzle efficiency as 90 % and that of turbine rotor 35 %, find the quality of steam used per hour and power developed.	Evaluation , Application	3
8	a) Explain the concept of Meta stable state while representing Wilson line on h-s diagram b). A Convergent divergent nozzle is to be designed in which steam initially at 14 bar and 80 ^{0} C of superheat is to be expanded down to a back pressure of 1.05 bar. Determine the necessary throat and exit diameters of the nozzle for a steam discharge of 500 kg/hour, assuming that the expansion is in thermal equilibrium throughout and the friction reheat amounting to 12 % of the total isentropic enthalpy drop to be effective in the divergent part of the nozzle	Application , Evaluation	3
9	a)What is the effect of friction on nozzle efficiency explain with T-S diagram b) A convergent divergent nozzle is required to discharge 2 kg of steam per second. The nozzle is supplied with steam at 6.9 bar and 180 0 C and discharge takes place against a back pressure of 0.98 bar. Expansion up to throat is isentropic and the frictional resistance between the throat and exit is equivalent to 62.76 kJ/kg of steam. Taking approach velocity of 75m/s. and throat pressure 3.9 bar, estimate (a) Suitable areas for the throat and exit	Application	3

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	(b)Overall efficiency of the nozzle based on the enthalpy drop between the actual inlet pressure, and the temperature and the exit pressure		
10	a) Derive the expression for exit velocity of a nozzle using Steadt flow energy equation. b) A steam nozzle is supplied steam at 15 bar 350 ^{0} C and discharges steam at 1 bar. If the diverging portion of the nozzle is 80 mm long and the throat diameter is 6 mm, determine the cone angle of the divergent portion. Assume 12 % of the total available enthalpy drop is lost in friction in the divergent portion. Also determine the velocity and temperature of the steam at throat.	Application	3
	UNIT – III		
1	a)Draw the velocity diagram of impulse Turbine and find the work done on the blade, blade efficiency b) A stage of a steam turbine is supplied with steam at a pressure of 50 bars and 350^{0}C, and exhausts at a pressure of 5 bars. The isentropic efficiency of the stage is 0.82 and the steam consumption is 2270 kg/min. determine the power output of the stage	Application , Comprehension	3, 4
2	(a)Derive the expression for condition for maximum efficiency of an impulse Turbine? (b) The velocity of steam exiting the nozzle of the impulse stage of a turbine is 400 m/s. The blades operate close to the maximum blading efficiency. The nozzle angle is 20 ^{0} .Considering equiangular blades and neglecting blade friction, calculates the steam flow of 0.6 kg/s. the diagram power and diagram efficiency	Knowledge, Comprehension	3, 4
3	a). What are the advantages and disadvantages of velocity compounded Impulse Turbine. b). In a DeLaval turbine, steam issues from the nozzle with a velocity of 1200m/sec, the nozzle angle is 20^0 , the mean blade velocity is 400m/sec and the inlet and outlet of angles are equal. The mass of steam flowing through the turbine per hour is 1000kg. Calculate blade angle,Power developed and blade efficiency.	Analysis, Comprehension	3, 4
4	a) Define the following: i) Blade efficiency ii) Stage efficiency iii)overall efficiency (b). A single stage steam Turbine is supplied with steam at 5bar and 200^{0}C at the rate of 50Kg/min. It expands into a condenser at a pressure of 0.2bar. The blade speed is 400m/sec. The nozzles are inclined at an angle of 20^0 to the plane of wheel and outlet blade angle is 30^0. Neglecting friction losses. Determine the power developed , blade efficiency and stage efficiency	Comprehension	3, 4
5	a) What are the methods of reducing wheel or rotor speed .explain b) In an impulse turbine (with a single row wheel) the mean diameter of the blades is 1.05m and the speed is 3000r.p.m. The nozzle angle is 18^0, the ratio of blade speed to steam speed is 0.42 and the ratio of the relative velocity at outlet from the blades to that at inlet is 0.84. The outlet angle of the blade is to be made 3^0 less than the inlet angle. The steam flow is 10kg/s. Draw the velocity diagram for the blades and derive the following: i)Tangential thrust on the blades ii)Axial thrust on the blades iii)Resultant thrust on the blades iv) Power developed in the blades v) Blading	Synthesis	3, 4

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	efficiency		
6	(a) What are the differences between Impulse turbine and reaction turbine (b) One stage of an impulse turbine consists of a converging nozzle ring and one ring of moving blade. The nozzles are inclined at 22^0 to the blades, whose tip angles are both 35^0. If the velocity of steam is at exit from nozzle is 660m/sec. Find the blade speed. So that the steam passes on without shock. Find the diagram efficiency neglecting losses if the blades are run at the speed	Comprehension, Synthesis	3, 4
7	a) Classify Steam turbine with different considerations b) Steam with absolute velocity of 300m/sec is supplied through a nozzle to a single stage impulse turbine. The nozzle angle is 25^0, the mean diameter of blade rotor is 1meter and it has a speed of 2000rpm. Find suitable blade angle for zero axial thrust. If the blade velocity coefficient is 0.9 and the steam flow rate is 10kg/sec. Calculate power developed.	Knowledge	3, 4
8	a) Explain the concept of pressure compounding. with neat diagramb).A simple impulse turbine has 1ring of moving blades running at 150m/sec. The absolute velocity of steam at exit from the stage is 85m/sec at an angle of 80^0 from the tangential direction.Blade velocity co-efficient is 0.8 and the rate of steam flowing through the stage is 2.5kg/sec. If the blades are equi angular, determine blade angle, nozzle angle and axial thrust.	Knowledge, Comprehension	3, 4
9	a) Explain the concept of velocity compounding. with neat diagram b)In a single stage impulse turbine, the nozzle angle is $20^0$and blade angles are equal. The velocity coefficient for blade is 0.85. Find maximum blade efficiency possible if the blade axial efficiency is 92% of maximum blade efficiency, find the possible ratio of blade speed to steam speed.	Synthesis, Comprehension	3, 4
10	a) Explain the concept of pressure and velocity compounding. with neat diagram b) In a single stage steam turbine, saturated steam at 10bar is supplied to a convergent divergent steam nozzle. The nozzle angle is 20^0 and the mean blade speed is 400m/sec. The steam pressure leaving the nozzle is 1bar. Find i)the best blade angle if the blades are equi angular ii) the maximum power developed by the turbine if a number of nozzles used are 5and area at the throat of each nozzle is $0.6cm^2$. Assume nozzle efficiency 88% and blade friction co-efficient is 0.87.	Comprehension	3, 4
	UNIT – III-B		
1	a) What are the types of Condensers? Classify? b) In a reaction turbine, the blade tips are inclined at 35^0 and 20^0 in the direction of motion. The guide blades are of the same shape as the moving blade, but reversed in the direction. At a certain place in the turbine, the drum diameter is 1m and the blades are at 10cm high. At this place the steam has a pressure of 1.75bar and dryness 0.935. If the speed this turbine is 250rpm and steam passes through the blades, without shock, find the mass of the steam flow and power developed in the ring of moving blades.	Application, Comprehension	3, 4
2	(a) Compare the Jet Condensers and Surface Condensers with?	Knowledge,	3, 4

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	Determine the mass of cooling water? b) A 50%reaction turbine with symmetrical velocity triangle running at 400rpm has the exit angle of the blade as 20^0 and the velocity of steam relative to the blade at the exit is 1.35times the mean blade speed. The steam flow rate is 8.33kg/sec and at a particular stage the specific volume is 1.381 m^3/kg. Calculate for this stage i)a suitable blade height, assuming the rotor mean diameter 12times the blade height and ii)the diagram work.	Comprehension	
3	a). Define degree of reaction and prove that Parsons Reaction turbine is a 50 % reaction turbine. b). 300kg/min of steam (2bar,0.98dry) flows through a given stage of a reaction turbine. The exit angle of fixed blade as well as moving blade is 200 and 3.68kW of power is developed. If the rotor speed is 360rpm and tip leakage is 5%, calculate the mean drum diameter and the blade height. If the axial flow velocity is 0.8times the blade velocity?	Analysis, Comprehension	3, 4
4	a) . Derive the condition for maximum efficiency of reaction turbine with giving assumptions to be followed. (b). A surface condenser is designed to handle 10000kg of steam per hour. The steam enters at 0.08bar abs. And 0.9dryness and the condensate leave at the corresponding saturation temperature. The pressure is constant throughout the condenser. Estimate the cooling water flow rate per hour if the cooling water temperature rise is limited to 10^0C.	Comprehension	3, 4
5	a) Define the terms Vacuum efficiency and Condenser efficiency. b) The volume of condenser which contains 0.144kg of air with steam is 4.05m^3. The temperature in the condenser is 40^0C and there is some water in the condenser. Determine the pressure in the condenser. R for air is 287joules/KgK.	Synthesis	3, 4
6	(a) Explain working principle of Low level Jet Condenser with neat sketches? (b) A steam jet turbo-generator develops 100 KW using 13.6 kg of steam per kWh. The exhaust steam pressure is 0.14 bar and 680.4 kg of cooling water are passed through the condenser per minute. The inlet and outlet temperatures are respectively 15.6^0C and 32.2^0C. Estimate the dryness fraction of exhaust steam. Temperature of hot well is 35^0C.	Comprehension, Synthesis	3, 4
7	a) Explain working principle of Surface Condenser with neat sketch? b) A closed vessel of 0.7 m^3 capacity contains saturated water vapor and air at a temperature of 42.7 ^{0} C and a pressure of 0.13 bar abs. Due to further air leakage into the vessel, the pressure rises to 0.28 bar abs. and temperature falls to 37.6 ^{0} C. Calculate the mass of air which has leaked in. Take R=287J/kg K for air.	Knowledge	3, 4
8	a)What the sources of air leakage in to the condensers? How its pressure is determined? b) The pressure under the air baffle of a surface condenser is 52mm of Hg. Temperature of the mixture leaving the cooler suction is 25^0C, assuming available water at 15.5^0C and external water might lower the temperature further to 20^0C. Explain the effect of this on the quantity of vapor accompanying the air to the air pump suction.	Knowledge, Comprehension	3, 4

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
9	a) Explain the function of cooling the air before it is to be extracted from the condenser? b) Steam enters the condenser at 30^0C and with barometer reading 760mm,if the vacuum of 695mm is produced , find the vacuum efficiency.	Synthesis, Comprehension	3, 4
10	a) Discus the merits and demerits of surface condensers and jet condensers, which type is recommended for large plants? b)In a reaction turbine, the fixed and moving blades are of same shape but reversed in direction. The angles of the receiving tips are 35^0 and of discharging tips are 20^0. Find the power developed in kW per pair of blade for a steam consumption of 2kg/sec, when the blade speed is 52m/sec, if the enthalpy drop in the pair is 10kJ/kg. Find the efficiency of the pair.	Comprehension	3, 4
	UNIT – IV		
1	(a) Explain the method INTER COOLING employed to increase the specific output and thermal efficiency of Gas Turbine plant? Draw the T-S diagram for the same. (b). The air enters the compressor of an open cycle constant pressure gas turbine at a pressure of 1bar and temperature of 20^0C. The pressure of the air after compression is 4bar. The isentropic efficiency of compressor and turbine are 80% and 85% respectively. The air-fuel ratio used is 90:1. If flow rate of air is 3.0kg/sec. Find i) power developed ii) thermal efficiency of cycle. Assume Cp = 1.0KJ/KgK , γ =1.4 of air and gases, calorific value of fuel is 41800KJ/Kg.	Comprehension , knowledge	3
2	(a). Explain the merits and demerits of closed cycle Gas Turbine over Open cycle Gas Turbine? (b). A gas turbine unit has a pressure ratio of 6:1 and maximum cycle temperature of 610^0C. The isentropic efficiencies of the compressor and turbine are 0.80 and 0.82 respectively. Calculate the power output in kilowatts of an electric generator geared to the turbine when the air enters the compressor at 15^0C at the rate of 16kg/s. Take Cp=1.005 kJ/kgK and γ =1.4 for the compression process, and take Cp=1.11kJ/kgK and γ =1.333 for the expansion process	Synthesis, Comprehension	3
3	(a) Describe with neat sketch, the working of a simple constant pressure open cycle Gas Turbine? (b) Find the required air-fuel ratio in a gas turbine whose turbine and compressor efficiencies are 85% and 80%, respectively. Maximum cycle temperature is 875^0C. The working fluid can be taken as air (Cp=1.0kJ/kgK, γ =1.4) which enters the compressor at 1bar and 27^0C. The pressure ratio is 4. The fuel used has calorific value of 42000kJ/kg. There is a loss of 10% of calorific value in the combustion chamber.	Comprehension, Analysis	3
4	(a). Explain with a neat sketch, the working of a constant volume combustion Turbine (b) A gas turbine plant consists of two turbines. One compressor turbine to drive compressor and other power turbine to develop power output and both are having their own combustion chambers which are served by air directly from the compressor. Air enters the compressor at 1bar and 288K and is compressed to 8bar with an	Analysis, Knowledge	3

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	isentropic efficiency of 76%. Due to heat added in the combustion chamber, the inlet temperature of gas to both turbines is 900^0C.The isentropic efficiency of turbines is 86% and the mass flow rate of air at the compressor is 23kg/s. The calorific value of fuel is 4200kJ/kg. Calculate the output of the plant and the thermal efficiency if mechanical efficiency is 95% and generator efficiency is 96%. Take Cp=1.005kJ/kgK and γ =1.4 for air and Cpg = 1.128kJ/kgk and γ = 1.34 for gases.		
5	a). Explain the method REHEATING employed to increase the specific output and thermal efficiency of Gas Turbine plant and also draw the T-S diagram for the same b) The pressure ratio of an open-cycle gas turbine power plant is 5.6. Air is taken at 30^0C and 1bar. The compression is carried out in two stages with perfect inter cooling in between. The maximum temperature of the cycle is limited to 700C. Assuming the isentropic efficiency of eac compressor stage as 85% and that of turbine as 90%, determine the power developed and efficiency of the power plant, if the air-flow is 1.2kg/s. The mass of fuel may be neglected, and it may be assumed that Cp= 1.02 kJ/kgK and γ = 1.41	Analysis Synthesis,	3
6	a). Explain the method REGENERATION employed to increase the specific output and thermal efficiency of Gas Turbine plant and also draw the T-S diagram for the same b) In an air-standard regenerative gas turbine cycle the pressure ratio is 5. Air enters the compressor at 1bar, 300K and leaves at 490K. The maximum temperature in the cycle is 1000K.Calculate the cycle efficiency, given that the efficiency of the regenerator and adiabatic efficiency of the turbine are each 80%. Assume for air the ratio of specific heats is 1.4. Also show the cycle on a T-S diagram	Analysis, Application	3
7	a) What is the effect of thermal efficiency of open cycle Gas Turbine with the following operating variables (i)Pressure ratio ii)Turbine inlet temperature iii)Compressor inlet temperature iv)Efficiency of the turbine v)Efficiency of compressor b) In a gas turbine, the compressor is driven by the high pressure turbine. The exhaust from the high pressure turbine goes to a free low pressure turbine, which runs the load. The air flow rate is 20Kg/sec and minimum and maximum temperatures are respectively 300K and 1000K. The compressor pressure ratio is 4. Calculate the pressure ratio of the low pressure turbine and temperature of exhaust gases from the unit. The compressor and turbine are isentropic. Cp=1.005kJ/kgK and γ =1.4 for air.	Comprehens ion	3
8	a). Draw the block diagram of closed cycle gas turbine plant and also represent the processes on T-S diagram with intercooler, heat exchanger and reheating processes. b). In a closed cycle gas turbine there is two stage compressor and two stage turbine. All the components are mounted on the same shaft. The pressure and temperature at the inlet of first stage compressor are 1.5bar and 20^0C, the maximum cycle temperature and pressure are limited to 750^0C and 6bar. A perfect intercooler is used between the two stage compressor and a reheater is used between the two turbines. Gasses are heated in the reheater to 750^0C before entering the L-P turbine. Assuming the compressor and	Analysis, Application	3

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	turbine efficiencies as 0.82. Calculatei) the efficiency of cycle without regenerator ii) the efficiency of the cycle with regenerator whose effectiveness is 0.70 iii) the mass of the fluid circulated if the power developed by the plant is 350Kw. The working fluid used in the cycle is air		
9	a) State the merits of gas turbines over IC engines and steam turbines. Discuss also the demerits over gas turbines. b). Air is taken in a gas turbine plant at 1.1bar and 20^0C. The plant comprises of L.P and H.P compressors and L.P and H.P turbines. The compression in L.P stage is up to 3.3bar followed by inter cooling to 27^0C. The pressure of air after H.P compressor is 9.45bar.Loss in pressure during inter cooling is 0.15bar. Air from H.P compressor is transferred to Heat exchanger of effectiveness 0.65 where it is heated by the gases of L.P turbine. After heat exchanger the air passes through combustion chamber. The temperature of the gases supplies to H.P turbine is 700^0C. The gases expand in H.P turbine to 3.62bar and air then reheated to 670^0C before expanding in L.P turbine. The loss of pressure in re-heater is 0.12bar. Determine i) the overall efficiency ii) the work ratio iii)mass flow rate when the power generated is 6000Kw. Assume isentropic efficiency of compression in both stages 0.82. Isentropic efficiency of expansion in turbine= 0.85. Cp=1.005kJ/kg K and γ =1.4 for air and C_{pg} = 1.128kJ/kg k and γ = 1.34 for gases neglect the mass of the fuel.	Synthesis, Application	3
10	a) Write a short notes on fuels used for gas turbines b)In a constant pressure open cycle gas turbine, air enters at 1bar and 20^0C and leaves the compressor at 5bar. Using the following data: temperature of gases entering the turbine=680^0C, pressure loss in the combustion chamber= 0.1bar. $\acute{\eta}_{compressor}$ = 85%, $\eta_{turbine}$ =80% $\acute{\eta}_{combustion}$= 85%,$\gamma$ =1.4, Cp= 1.02 kJ/kgK for air and gas. Find i) the quantity of air circulation, if the plant develops 1065Kw ii) heat supplied for Kg of air circulation iii) thermal efficiency of the cycle. Mass of the fuel may be neglected	Comprehension	3
	UNIT – V		
1	a) Draw the sketch of Turbo-Jet plant with T-S diagram of Turbo-Jet engine and explain? b) a)A turbojet has a speed of 750km/h while flying at an altitude of 10000m, the propulsive efficiency of the jet is 50% and overall efficiency of the turbine plant is 16%.The density of air at 10000m altitude is 0.173kg/m3. The drag on the plank is 6250 N, the calorific value of the fuel is 48000KJ/Kg. Calculate. i). absolute velocity of the jet . ii) volume of the air compressed per minute	Application	1
2	a) A turbojet engine flying at a speed of 960km/hour consumes air at the rate of 54.5kg/sec. Calculate i) exit velocity of the jet when the enthalpy change for the nozzle is 200Kj/kg and velocity co-efficient is 0.97. ii) fuel flow rate in kg/sec, when air fuel ratio is 75:1. b) For the above problem also calculate i) thrust specific fuel consumption ii) Thermal efficiency of the plant when the combustion efficiency is 93 % and calorific value of the fuel is 45000 kJ/kg. iii) Propulsive power and efficiency	Comprehension, Knowledge	1

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
3	(a). Explain the working principle of Ram-Jet with diagram (b) A turbo-jet engine consumes air at the rate of 60.2 kg/s when flying at speed of 1000km/h. Calculate: i)Exit velocity of the jet when the enthalpy change for the nozzle is 230KJ/Kg and velocity co-efficient is 0.96. ii) Fuel flow rate in Kg/sec when air-fuel ratio is 70:1iii) Thrust specific fuel consumption iv) Thermal efficiency of the plant when the combustion efficiency is 92% and calorific value of the fuel used is 42000KJ/kg. v)Propulsive power vi)propulsive efficiency vii)Overall efficiency.	Comprehension	1
4	a)What are the advantages and disadvantages of Pulse Jet engines? b)In a jet propulsion unit, the total pressure and temperature at intake to the compressor are 0.6bar and 0^0C the speed of the propulsion unit is 190m/sec. The total temperature and total pressure of gases after the combustion entering the turbine 750^0C and 3.1bar. The speed of the propulsion unit is 190m/sec. The isentropic efficiencies of compressor and turbine are 85% and 80% respectively. The static back pressure of the propulsion nozzle is 0.52 bar and the efficiency of the nozzle based on total pressure drop available is 90%. Determine (a) power consumed by the compressor per kg of air(b) the air-fuel ratio if the calorific value of fuel is 41840kJ/kg of fuel (c) the total pressure of gas leaving the turbine (d) thrust per kg of air per second.	Application	1
5	a) What are the requirements of an ideal Rocket propellant and applications of Rockets. b) Explain Thrust, Thrust Power, efficiency and Thermal efficiency of Turbo Jet	Comprehension, Knowledge	1
6	a) Explain the thermal analysis of turbojet engine b) Draw the T-S diagrams and explain the processes for Turbo-jet engine?	Synthesis, Knowledge	1
7	a) Explain the working difference between propeller jet ,turbo-jet b) Explain the function of and turbo prop with a neat sketch?	Analysis, Comprehension	1
8	a) State the fundamental differences between the jet propulsion and rocket propulsion b) A high altitude flight jet propeller air craft is flying with a speed of 367m/sec, the ambient atmospheric pressure and temperature are 0.01 Mpa and -40^0C. The temperature and the pressure of the gases entering the turbine are 827^0C and 0.2Mpa, isentropic efficiency of compressor and turbine are 80% and 85% respectively. The ram air efficiency is 80%. The back pressure on the nozzle may be assumed as ambient pressure and efficiency of nozzle base on total pressure drop available is 90%. Neglecting the other losses and mass increased due to fuel consume. Determine compressor power per kg per sec and thrust per kg per sec. Also calculate thermal efficiency. Assume for gasses in combustion chamber, turbine and jet pipe Cp=1.12kJ/kgK and γ = 1.33 and for air γ = 1.4 and R=0.287kJ/kgK.	Knowledge, Comprehension	1
9	a). Classify rockets and explain solid and liquid propellant rockets b)A turbojet aircraft is flying at a speed of 287m/sec, where the ambient conditions are 0.5bar and -200C. The compressor pressure ratio is 8.The maximum cycle temperature is not to exceed 1250K,	Comprehension, Knowledge	1

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	with fuel of calorific value of 44000kJ/kg. The pressure loss in the combustion chamber is 0.1bar. The various efficiencies are listed as Ram air efficiency is 90%, Isentrophic efficiency of compressor and turbine are 85% and 80%respectively. Combustion efficiency is 98%, nozzle efficiency is 90%. If the outlet area of the nozzle is 0.1m2. Determine the mass flow rate, the thrust developed and specific fuel consumption.		
10	a) What are the advantages and disadvantages of turbojet engines? b) Explain with the help of entropy and enthalpy diagrams a turbojet gas turbine plant? How it is differs from Turbo Prop plant?	Knowledge Comprehension	1