GUJARAT TECHNOLOGICAL UNIVERSITY

BE-6 SEMESTER – OLD PAPER – S22 TO W25 – QUESTION BANK

Subject Name & Code:

APPLIED THERMODYNAMICS (3161910)

Unit 1: Properties of Gases and Gas Mixtures

Repeated Questions:

1. **Explain/Define Vander Waal's Equation of State. Derive an expression for Evaluation of Constant 'a' and 'b'.**
   (S25 - Q2c, 07 marks) (S23 - Q2c, 07 marks) (W22 - Q2 OR, 07 marks) (W23 - Q1c, 07 marks)
2. **Define/State and explain Avogadro's law.**
   (W24 - Q1a) (W23 - Q1a, 03 marks)
3. **What is compressibility chart? What are the observations can be made from this chart?**
   (S25 - Q5 OR a, 03 marks) (S24 - Q1a)

Other Important Questions:

1. Define Avogadro's law, equation of state, Indicated Power. (W23 - Q1a, 03 marks)
2. Derive the Vander walls equation. (W23 - Q1c, 07 marks)
3. Define the following terms: (a) Stagnation temperature (b) Stagnation velocity of sound (c) Mach number (d) Stagnation Pressure (S22 - Q1b, 04 marks)
4. Explain in brief reduced properties of gas and critical compressibility factor. (S22 - Q2b)
5. Derive equation of constants employed in Vander Waal's equation. (W25 - Q1b)
6. The following details were noted in a test on a 4- cylinder, 4- stroke engine: cylinder diameter $= 100\text{mm}$; stroke length $= 120\text{mm}$; speed of the engine $= 1600\text{rpm}$; fuel consumption $= 0.2\text{kg/min}$; CV of the fuel $= 44000\text{kJ/kg}$; difference in tension on either side of the brake pulley $= 40\text{kg}$; brake circumference is 300cm . If the mechanical efficiency is 80% calculate, brake and indicated thermal efficiency, indicated mep, brake specific fuel consumption. (W25 - Q4c, 07 marks)
7. A vessel of 8m^3 capacity contains two gases A and B in proportion of 40% and 60% respectively at $32°\text{C}$. If the value of R for the gases is 0.29kJ/kgK and 0.296kJ/kgK and if the total weight of the mixture is 3kg . Determine (1) the partial pressure (2) the total pressure (3) the mean value of R for the mixture. (S24 - Q2c, 07 marks)
8. 1 kg of oxygen occupies a volume of $0.25\text{m}^3/\text{kg}$ at 330K is subjected to isothermal expansion process tillit's volume becomes $0.75\text{m}^3/\text{kg}$. Assuming that the gas obey Vanderwall's gas equation, find the final pressure of the gas and the work done during the process. Assume Vanderwall's gas constant as: $\text{a} = 138000\text{Nm}^4/(\text{kg}_{\text{mol}})^2$, $\text{b} = 0.0318\text{m}^3/\text{kg}_{\text{mol}}$ (S23 - Q2 OR c, 07 marks)
9. Explain Compressibility Chart and Compressibility Factor with neat Sketch. (W22 - Q1b)
10. Briefly explain the following with $p - V$ diagram (i) Time loss factor (ii) Heat loss factor (iii) Exhaust blowdown factor (S22 - Q1c, 07 marks)
11. State the assumptions to be made for fuel-air cycle analysis. (S23 - Q1a, 03 marks)

Unit 2: Psychrometry

Repeated Questions:

1. **Explain Dalton's law of partial pressure.**
   (S25 - Q2a, 03 marks) (W22 - Q2a, 03 marks) (S22 - Q1a) (W23 - Q3b, 04 marks)
2. **Define/Explain the following: (i) Dew point temperature (ii) Relative humidity (iii) Wet bulb temperature.**
   (S25 - Q5a, 03 marks) (S24 - Q1c) (W24 - Q1c) (S23 - Q1b, 04 marks) (W22 - Q1a, 03 marks) (S22 - Q3b, 04 marks)
3. **What is Psychometric chart? Explain the measurement of different lines on it.**
   (S25 - Q4c, 07 marks) (W22 - Q1c)

Other Important Questions:

1. Define the following; (i) Relative Humidity, (ii) wet bulb depression, (iii) Dew point temperature. (S25 - Q5a, 03 marks)
2. Define (1) Dry bulb temperature (2) Wet bulb temperature (3) Dew point temperature (W22 - Q1a, 03 marks)
3. Explain chemical dehumidification process. (W25 - Q3b, 04 marks)
4. Explain humidification and dehumidification process with the help of psychrometric charts. (S22 - Q3 OR b, 04 marks)
5. Explain chemical and dehumidification with neat sketch. (W23 - Q3 OR c, 07 marks)
6. Explain the cooling and dehumidification with neat sketch. (W23 - Q3 OR c, 07 marks)
7. Define: (i) Absolute humidity (ii) Dry bulb temperature (iii) Dew point temperature (iv) Wet bulb temperature (S22 - Q3b, 04 marks)
8. Explain with neat sketch about working and construction of the sling psychrometer. (W24 - Q2b)
9. Explain adiabatic saturation process with neat sketch. (W24 - Q3b)
10. Atmospheric air at 101.325kPa has 30°C DBT and 15°C DPT. Without using psychrometric chart calculate partial pressure of air and vapour, specific humidity, relative humidity, vapour density and enthalpy of moist air. (S23 - Q3 OR c, 07 marks)
11. In a cooling application, air at 32°C DBT and 20°C WBT is passed through a cooling coil maintained at 5°C . The heat removed by the cooling coil from air is 14kW and air flow rate is $42.5\text{m}^3/\text{min}$. Determine (i) DBT and WBT of the air leaving the coil, (ii) coil by-pass factor. (W25 - Q2 OR c, 07 marks)
12. Explain sensible cooling process. (S23 - Q3a, 03 marks)
13. Define Psychrometry? Define sensible heat factor. (W23 - Q3a, 03 marks)
14. Explain properties of moist air. (W23 - Q3 OR b, 04 marks)

Unit 3: Refrigerant and Refrigeration Cycles

Repeated Questions:

1. **Explain/State desirable characteristics/properties of (a good) refrigerant.**
   (S25 - Q1c, 07 marks) (S24 - Q2b) (W22 - Q2c, 07 marks) (S22 - Q3a, 03 marks)
2. **Explain designation/system of refrigerants.**
   (S25 - Q5b, 04 marks) (W23 - Q3a, 03 marks) (S23 - Q2b, 04 marks) (W22 - Q5b, 04 marks)
3. **Explain/Differentiate between Vapour Compression System and Vapour Absorption System.**
   (S24 - Q2a) (W22 - Q2b, 04 marks)
4. **Explain Li-Br Vapour Absorption System with neat sketch.**
   (S25 - Q3c, 07 marks) (W25 - Q2c, 07 marks) (S22 - Q3 OR c, 07 marks) (W22 - Q3b, 04 marks)
5. **Explain Global Warming Potential (GWP) of refrigerants.**
   (S25 - Q4b, 04 marks) (S23 - Q3a, 03 marks)
6. **Explain flash intercooling.**
   (S24 - Q3a, 03 marks) (S22 - Q3a, 07 marks)

Other Important Questions:

1. Draw schematic diagram and p-h chart for simple vapor compression refrigeration cycle. (S25 - Q1b, 04 marks)
2. Explain working of two stage compression with liquid intercooler with neat sketch and p-h diagram. (S23 - Q3c, 07 marks)
3. Explain with neat sketch, two stage compression system with flash intercooler. (W24 - Q2 OR c)
4. Explain Thermodynamic, Physical and Chemical Properties of Refrigerants (W22 - Q3c, 07 marks)
5. What are secondary refrigerants? State advantages of secondary refrigerants. (S23 - Q3 OR b, 04 marks)
6. Discuss briefly secondary refrigerants. (W23 - Q3 OR a, 03 marks)
7. Explain Ozone Depletion Potential (ODP) and Global Warning Potential (GWP). (W22 - Q5 OR b, 04 marks)
8. How ODP and GWP does affect refrigerant selection? (S22 - Q2a, 03 marks)
9. Enlist various desirable properties of good refrigerant. (W25 - Q2a, 03 marks)
10. How will you assign number to the refrigerants: Dichloro difluoro methane and dichloro tetra fluoro ethane? (S22 - Q3 OR a, 03 marks) (W24 - Q3b)
11. The COP of a refrigerator is 6, when it maintains the temperature of $-3°C$ in the evaporator. Determine the condenser temperature and refrigerating effect if the power required to run the refrigerator is $7.5kW$. (W25 - Q3 OR a)
12. In an absorption system heating cooling and refrigeration takes place at temperature of $115°C30°C$ and $-20°C$ respectively find theoretical COP of the system. If the generator temperature increased to $200°C$ and evaporator temperature decreased to $-40°C$, find the % change in COP of system. (S23 - Q3b, 04 marks)
13. A R-134a two stage refrigeration system operates between the pressure limits of 1.3 bar and 7.7 bar. The refrigerant leaves the condenser as a saturated liquid and is throttled to a flash chamber operating at 2.9 bar. The part of refrigerant evaporates during the flashing process and this vapour is mixed with the refrigerant leaving the low pressure compressor. Then, the mixture is compressed to the condenser pressure by the high pressure compressor. The liquid in the flash chamber is throttled to the evaporator pressure and cools the refrigerated space. The refrigerant entering lower stage compression is saturated vapour. The mass of refrigerant circulates through condenser is $8kg/min$. Calculate: (1) Mass of liquid refrigerant evaporates in flash chamber (2) Refrigerating capacity and compressor work supplied (3) COP of the system (S24 - Q2 OR c, 07 marks)
14. An ammonia compound compression of refrigeration system consists of two evaporators of capacities 20TR at -10°C, and 10TR at 10°C. The vapours leaving the evaporators are dry and

saturated. The condenser temperature is 40°C. the system is provided with multiple expansion valves and flash intercooler. Calculate 1) mass of refrigerant passing through each compressor, and 2) COP of the system. (W22 - Q3 OR c, 07 marks)

15. A refrigerating machine working on reversed Carnot cycle consumes 5.5kW for producing refrigerating effect of 940kJ/min for maintaining a region at - 38°C . Determine: (i)COP of refrigerating machine; (ii)Highest temperature of cycle; (iii)Amount of heat delivered in kJ/min, when this device is used as a heat pump. (W24 - Q4c)
16. Mention the limitations of simple vapour compression refrigeration cycle. Briefly explain the working of two stage compression with water intercooler and liquid sub-cooler employed for vapour compression system. (W24 - Q3c)
17. What is the effect of sub-cooling on the performance of vapour compression refrigeration system? (W24 - Q2a)
18. Explain with neat sketch the working of a simple ammonia water absorption refrigeration system. (W24 - Q4c)
19. Explain with schematic diagram of simple vapor compression cycle. Draw the p-h and T-S diagram simple vapor compression cycle. (W24 - Q5 OR c)
20. State the advantages and disadvantages of vapour absorption refrigeration system over vapor compression refrigeration system. (W24 - Q5 OR b)

Unit 4: Fuel Air and Actual Cycles

Repeated Questions:

1. **Derive an Expression for Velocity of Sound Wave in Compressible Fluid Flow and also Express in terms of Bulk Modulus.**
   (S25 - Q3c, 07 marks) (S24 - Q3c) (S23 - Q4c, 07 marks)
2. **What are the different Losses in Actual Cycle? Explain any two with neat sketch.**
   (S24 - Q4b) (W22 - Q4 OR b, 04 marks)
3. **Difference between Euro norms and Bharat stage norms.**
   (S25 - Q4 OR a, 03 marks) (S22 - Q4a, 03 marks)

Other Important Questions:

1. Prove that velocity of sound wave is the square root of the ratio of the change in pressure to the change in density of a fluid due to disturbance in compressible flow. (W25 - Q1c)
2. What is loss due to dissociation? Explain effect of dissociation on temperature and power in engine. (W25 - Q3c, 07 marks)
3. Explain dissociation loss and its effect on maximum temperature and pressure of the cycle. (S23 - Q4b, 04 marks)
4. Explain the phenomenon of dissociation. (S24 - Q4 OR b)
5. Explain time loss, spark timing loss and heat loss in actual cycle. (S23 - Q4 OR b, 04 marks)
6. Explain why the specific heats of gases increase with increases in temperature? (S24 - Q3b, 04 marks) (W24 - Q3a)
7. How do the specific heat vary with temperature? What is the physical explanation for this variation? (S22 - Q4b, 04 marks)
8. Explain the effect of compression ratio on fuel air cycle analysis. (S24 - Q1b)
9. Explain actual cycle for SI engine with p-v diagram. (W25 - Q3 OR b, 04 marks)
10. Draw P - V diagrams of Otto and Diesel cycle and show the effect of variation of specific heat with temperature on the same. (S24 - Q3b)
11. Give a Comparison between Air- Standard Cycle, Fuel- Air Cycle and Actual Cycle. (W22 - Q5 OR a, 03 marks)
12. What is the difference between air standard cycle and fuel-air cycle analysis? (S22 - Q4 OR b, 04 marks)
13. In a diesel cycle, air at the beginning of compression is 1 bar and $50°C$. The air-fuel ratio is 25:1 and compression ratio is 15. Assuming $Cv = 0.71 + 21 \times 10^{-5}T$ and law of compression is $pv^{1.35} =$ constant. Calculate the % stroke at which combustion is completed. Take calorific value of fuel as $44000kJ/kg$ and $R = 287J/kg - K$. (S23 - Q4 OR c, 07 marks)
14. Differentiate between Otto cycle and Diesel cycle. (S25 - Q2b, 04 marks)
15. Prove that velocity of a sound wave in a compressible fluid is given by $C = \sqrt{\gamma RT}$. (W24 - Q4b)
16. Derive an expression for the area velocity relationship for a compressible fluid in the form $\frac{dA}{A} = \frac{dV}{V}[M^2 - 1]$ (S24 - Q4 OR c)

Unit 5: IC Engine Performance and Emissions

Repeated Questions:

1. **Define: Indicated power, Brake power, (Friction power), Mechanical efficiency, Brake specific fuel consumption.**
   (W22 - Q4c, 07 marks) (W24 - Q2c) (S22 - Q4 OR a, 03 marks) (S25 - Q1a/Q3a, 03 marks)
2. **Explain with neat sketch Catalytic Converter used in SI Engines.**
   (S25 - Q4a, 03 marks) (W22 - Q4a, 03 marks) (S23 - Q5a, 03 marks) (S22 - Q4 OR c, 07 marks)
3. **Write short note on/Explain in brief about "Heat Balance Sheet".**
   (S25 - Q3 OR b, 04 marks) (W22 - Q4b, 04 marks) (W23 - Q4b, 04 marks)

Other Important Questions:

1. Define: Brake power, indicated power and brake specific fuel consumption. (W25 - Q1a)
2. Define. Brake power, Friction Power, Brake specific fuel consumption. (W23 - Q4a, 04 marks)
3. Give difference between Euro norms Bharat stage emission norms. (W25 - Q3a, 03 marks)
4. Write down Bharat stages of emission norms. (W23 - Q4a, 03 marks)
5. Define EURO and INDIAN (Bharat) norms. (W23 - Q4b, 04 marks)
6. What are the international accepted methods for measuring the NO_x , CO and HC? (S24 - Q4a)
7. What are the major pollutants emitted from diesel engine? (S23 - Q4 OR a, 03 marks)
8. What are the major pollutants comes out from the IC engine? (W24 - Q5 OR a)
9. Explain Exhaust Gas Recirculation System with neat Sketch. (W25 - Q4b, 04 marks) (W22 - Q4 OR a, 03 marks)
10. What is variable compression Ratio (VCR) engine? Explain methods of obtaining VCR and performance of VCR engine. (W23 - Q4c, 07 marks)
11. Write short note on variable compression ratio engine. (S23 - Q5b, 04 marks)
12. Explain the different methods adopted to obtain variable compression ratio in I. C. engine. (S24 - Q3a)
13. Define engine. What are the main objectives of IC engine testing? (S23 - Q2a, 03 marks)
14. A four cylinder engine running at 1200rpm delivers 20kW . The average torque when one cylinder was cut is 110Nm . Find the indicated thermal efficiency if the calorific value of the fuel is 43MJ/kg and the engine uses 360grams of gasoline per kWh . (S22 - Q4c, 07 marks)
15. A six cylinder, gasoline engine operates on the four stroke cycle. The bore of each cylinder is 80mm and the stroke 100mm . the clearance volume per cylinder is 70cc . at a speed of 4000rpm the fuel consumption is 20kg/h and the torque developed is 150Nm . Calculate (i) the brake power (ii) brake mean effective pressure (iii) brake thermal efficiency if the calorific value of the fuel is 43000kJ/kg . (S22 - Q4 OR c, 07 marks)
16. A single cylinder, four stroke gas engine has bore and stroke are 225mm and 325mm respectively. the clearance volume is 1.8ltrs . The gas consumption is $12.1\text{m}^3\text{/hr}$ when the engine runs at 500rpm with impe 700KN/m^2 . The calorific value of fuel is $40{,}000\text{kJ/m}^3$. Find : indicated power, thermal efficiency, air standard efficiency, relative efficiency, take $Y = 1.4$. (W22 - Q4c, 07 marks)
17. The following observations were recorded from test on a single cylinder four stroke oil engine having following parameters : cylinder bore $= 150\text{mm}$, engine stroke $= 250\text{mm}$, engine speed $= 420\text{rpm}$, brake torque $= 217\text{N} - \text{m}$, fuel consumption $= 2.95\text{kg/h}$, calorific value of fuel $= 44000\text{kJ/kg}$, cooling water flow rate $= 0.068\text{kg/s}$, cooling water temperature rise $= 45\text{K}$, specific heat capacity of cooling water $= 4.18\text{kJ/kg} - \text{K}$, mean effective pressure $= 7.5$ bar, calculate (i) mechanical efficiency (ii) brake thermal efficiency (iii) specific fuel consumption (iv) draw heat balance sheet. (S23 - Q5c, 07 marks)
18. From the data given below, draw an energy balance sheet for a two stroke diesel engine run for 30 minutes at full load: RPM - 350, Mena effective pressure - 3 bar, Net brake load - 650 N, Fuel consumption - 1.8kg , Air used - 32kg/kg of fuel, Cylinder bore - 210 mm, Cylinder stroke - 260mm , Brake diameter - 1m , Cooling water supplied - 175 kg, Water input

temperature - $30^{\circ}C$, Water output temperature $60^{\circ}C$, Room temperature - $25^{\circ}C$, Exhaust gas temperature - $300^{\circ}C$, Steam formed in exhaust - 1.3kg/kg of fuel, Specific heat of steam in exhaust - $2kJ/kgK$, Specific heat of dry exhaust gas - $1.005kJ/kgK$, Calorific value of fuel - $43{,}000kJ/kg$ (S24 - Q4c)

19. A two stroke diesel engine was motored when the meter reading was $1.5kW$. Then the test on the engine was carried out for one hour and the following observations were recorded: Brake torque $= 120Nm$; Speed $= 600rpm$; Fuel used $= 2.5kg$; calorific value of fuel $= 40.3MJ/kg$; Cooling water used $= 818kg$; Rise in temperature of cooling water $= 10^{\circ}C$. Exhaust gas temperature $= 345^{\circ}C$. Room temperature $= 25^{\circ}C$; $A/F = 32:1$; Determine: (i) bp, (ii) ip, (iii) mechanical efficiency, (iv) indicated thermal efficiency, and (v) Draw heat balance sheet on minute basis and also on percentage basis. (W24 - Q5c)
20. Explain various methods of obtaining friction power and explain any one of them in detail. (W24 - Q3c)

Unit 6: Reciprocating Compressors

Repeated Questions:

1. **What is the need/Justify the need for multistaging in reciprocating compressor?**
   (W25 - Q4a, 03 marks) (W22 - Q3a, 03 marks) (S23 - Q1c, 07 marks)
2. **Derive the equation of work done on air for multi-stage reciprocating air compressor. / Show that for a two-stage reciprocating air compressor with complete intercooling the total work of compression becomes minimum when the pressure ratio in each stage is equal.**
   (S25 - Q2 OR c, 07 marks) (S23 - Q1c, 07 marks) (S22 - Q5c, 07 marks)
3. **What is the effect of clearance on the performance of air compressor?**
   (W22 - Q5b, 04 marks) (W24 - Q5a)

Other Important Questions:

1. Derive an expression for minimum work input to compress the air in two stage reciprocating compressor. (S24 - Q5c)
2. With usual notations derive an expression for indicated work of reciprocating air compressor by considering clearance. (S22 - Q5 OR c, 07 marks)
3. Explain methods of reducing compressor work done in single stage reciprocating air compressor without clearance. (S24 - Q5 OR b)
4. Give classification of compressors. (W25 - Q2b, 04 marks)
5. Give advantages and disadvantages of multistage reciprocating air compressor over Single stage air compressor. (W24 - Q4a)
6. Explain with a neat sketch the construction and working of a single stage single acting reciprocating air compressor. (W23 - Q5 OR c, 07 marks) (W24 - Q4b)
7. How are air compressor classified? (W24 - Q5b)
8. State the important uses of compressed air for engineering purpose. (W24 - Q3a) (W23 - Q5a)

Unit 7: Centrifugal Compressors

Repeated Questions:

1. **Explain the phenomenon of surging and choking/stalling in a centrifugal/axial flow compressor.**
   (S25 - Q5 OR b, 04 marks) (W25 - Q5b, 04 marks) (S24 - Q5a) (W23 - Q5a, 03 marks) (W22 - Q3b)
2. **Differentiate between centrifugal and axial flow compressor.**
   (S25 - Q3b, 04 marks) (S23 - Q4a, 03 marks) (W22 - Q3 OR a, 03 marks) (W23 - Q2 OR c, 07 marks)
3. **Explain various losses in centrifugal compressor.**
   (W25 - Q4 OR c, 07 marks) (S23 - Q4 OR b, 04 marks)
4. **Explain effect of pre-whirl in centrifugal compressor.**
   (W25 - Q5a, 03 marks) (S22 - Q5a, 03 marks)

Other Important Questions:

1. Explain with neat Sketch Effect of Impeller Blade Shape on Performance in Centrifugal Compressor. (S25 - Q4c, 07 marks) (W25 - Q5c, 07 marks)
2. Define following terms with reference to centrifugal compressor: (i) Isentropic efficiency (ii) Power input factor (iii) Slip factor (iv) Pressure coefficient. (S24 - Q5b)
3. Explain the Influence of inlet and outlet blade angles on the performance of centrifugal compressor. (S22 - Q5 OR b, 04 marks)
4. What is centrifugal compressor and what are its advantages? (W23 - Q5 OR a, 03 marks)
5. Differentiate between positive displacement compressor and dynamic compressor. (S24 - Q5a)
6. For a multistage axial flow compressor, initial state of air is 1 bar, 30°C and final state is 6 bar, 300°C . Calculate the overall isentropic and polytropic efficiencies. When the actual temperature rise per stage is 16 °C , calculate the number of stages required, assuming polytropic efficiency as the stage efficiency. (S23 - Q4 OR c, 07 marks)

Unit 8: Axial Flow Compressors & Compressible Flow Fundamentals

Repeated Questions:

1. **Define/Explain: Mach number, Mach angle, Mach cone, zone of action, zone of silence.** (S25 - Q3 OR a, 03 marks) (W23 - Q1b/Q2b, 04 marks) (S23 - Q4 OR a, 03 marks)
2. **Explain Fundamental equations for compressible flow.** (S25 - Q5c, 07 marks) (W23 - Q2c, 07 marks)

Other Important Questions:

1. Define Mach Number and state its significance in compressible fluid flow. (W23 - Q1b, 04 marks)
2. What is Mach number? Why is this parameter so important for the study of flow of compressible fluid. (S25 - Q4 OR b, 04 marks) (S24 - Q4 OR a)
3. What are the different regions of compressible flow? (W23 - Q2a, 03 marks)
4. Define compressible and incompressible flow. (W25 - Q4 OR a, 03 marks) (W22 - Q5a, 03 marks) (W24 - Q4a)
5. Explain Mach angle and Mach cone. (W25 - Q5 OR a, 03 marks)
6. Explain Propagation of Pressure Waves Distribution in a Compressible Fluid with neat Sketch. (W25 - Q5b, 04 marks)
7. Derive the following from one dimensional steady flow energy equation and also explain various regions of flow based on it: $\frac{a^2}{\gamma-1}+\frac{V^2}{2}=\frac{a_0^2}{\gamma-1}=\frac{V_{max}^2}{2}=\frac{a^{*2}\gamma+1}{2\gamma-1}=h_0$ (S22 - Q2 OR c)
8. What is the effect of compressibility on Mach number? Prove for $\gamma = 1.4$ $\frac{P_0-P}{\frac{1}{2}\rho V^2}=1+\frac{M^2}{4}+\frac{M^4}{40}+\cdots$ ... ... (S22 - Q2c)
9. What are the stagnation Properties? Derive an equation for Stagnation Pressure and Stagnation Density. (W22 - Q5 OR c, 07 marks)
10. With a suitable sketch explain the working principle of an axial flow compressor. What is meant by a stage and explain the stage velocity triangles. (W23 - Q5b, 07 marks)
11. Explain the use of aerofoil blading in axial flow compressor. (W25 - Q5 OR c, 07 marks)
12. What do you mean by lift and drag? (S22 - Q5 OR a, 03 marks)
13. Define flow co-efficient and work co-efficient with reference to axial flow compressor (S24 - Q5 OR a)
14. An axial flow compressor stage has mean diameter of 60cm and runs at 15000rpm . If the actual temperature rise and pressure ratio developed are $30°\text{C}$ and 1.35 respectively. Determine: (1) power required to drive the compressor while delivering 57kg/s of air, if mechanical efficiency is 86% and inlet temperature $35°\text{C}$ (2) the stage loading co-efficient (3) the stage efficiency (4) the degree of reaction if the temperature at the rotor exit is $55°\text{C}$. (S24 - Q5 OR c)

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