

**KSIT**

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
FIRST INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: A

USN									
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Degree : B. E.
 Branch : Mechanical Engineering
 Course Title : THERMODYNAMICS
 Duration : 90 Minutes

Semester : III
 Course Code : 21ME34
 Date : 30/11/2022
 Max Marks : 20

Note: Answer ONE full question from each part.

K-Levels: K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
PART-A				
1(a)	200 kJ of work is supplied to a closed system. The pressure and volume is related by $P = 8 - 5V$, P is in bar and V in m^3 . The initial volume is $0.5 m^3$. Calculate final pressure and volume	4	CO3	K3
(b)	A heat engine is used to drive a heat pump. The heat transfer from engine and heat pump are used to heat water circulating through the radiators of a building. The efficiency of heat engine is 27% and COP of heat pump is 4. Solve for the ratio of the heat transfer to the radiator circulation water to the heat transfer to the engine	4	CO3	K3
(c)	In 1709, Sir Isaac Newton proposed a new temperature scale. On this scale, temperature was a linear function on Celcius scale. The reading on this at ice point ($0^{\circ}C$) and Normal human body temperature ($37^{\circ}C$) were $0^{\circ}N$ and $12^{\circ}N$ respectively. Develop the relation between Newton scale and Celcius scale	4	CO3	K3
OR				
2(a)	A piston cylinder arrangement is containing fluid at 1 MPa and volume of $0.05 m^3$. Find the work done by the fluid when it expands reversibly for the following cases (i) At a constant pressure to a final volume of $0.2 m^3$ (ii) According to law $PV = C$ to a final volume of $0.2 m^3$.	4	CO3	K3
(b)	An inventor claims to have devised a cyclic engine which exchanges heat with the reservoir at 300K and 540K and which can produce 450J work per 1000J of heat extracted from the heat reservoir. Identify whether his claim is possible?	4	CO3	K3
(c)	The resistance of a platinum wire is found to be 11 ohm at ice point, 15.247 ohm at the steam point and 28.887 ohm at the Sulphur point. Calculate the value for constants A & B in the equation, $R = R_0 [1 + At + B t^2]$	4	CO3	K3
PART -B				
3(a)	Distinguish between (i) intensive and extensive properties (ii) Open and Closed system	4	CO1	K2
(b)	With a neat PV diagram, illustrate an expression for work done for polytropic and constant volume process by deriving from fundamentals.	4	CO1	K2
OR				
4(a)	Explain zeroth law of thermodynamic and its significance	4	CO1	K2
(b)	Explain cannot refrigerator and develop the relation $(COP)_{hp} = (COP)_{ref} + 1$	4	CO1	K2

Name & Signature of
 Course In charge
 (Dr. Nagaprasad Ks)

Name & Signature of
 Module Coordinator
 (Dr. Nagaprasad Ks)

HOD ME

Principal
 Selected



K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
I SESSIONAL TEST 2022 - 23(ODD SEMESTER)

SCHEME AND SOLUTION (SET A)

Degree : BE
Branch : ME
Course Title : THERMODYNAMICS

Semester : III
Course Code : 21ME34
Max Marks : 20

Q. No	SOLUTION	MARKS
	<u>PART-A</u>	
1(a)	$W = - 150\text{kJ}$ $V_2 = 0.35\text{m}^3$	01 +03= 04
1(b)	$Q_2 = 0.78Q_1$; Ans: 1.81	01 +03=04
1(c)	Newton scale expression $t = 3 \text{ t(N)}$	02+ 02=04
2 (a)	$W = - 5.75\text{kJ}$ $V_2 = -2.25\text{kJ}$	02+ 02=04
2(b)	Efficiency = 75% Ans: Impossible	02+ 02 = 04
2(c)	$R_o = 11 \text{ ohm}$; $A = 1.353$; $B = -2.64$	01+ 03=04
	<u>PART-B</u>	
3 (a)	Explain depends on size; mass and energy can interact;	02+ 02 = 04
3(b)	Sketch; $W = p(V_2 - V_1)$	01+ 03 = 04
4(a)	Sketch with parts A,B,C; Statement + temperature measurement	01+ 03= 04
4(c)	Carnot refrigerator sketch+explanation; Derivation	02+ 02= 04

Signature of Course In-charge

Module In-charge

Head of the Department



K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
FIRST INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: B

USN

Degree : B. E.,
Branch : Mechanical Engineering
Course Title : THERMODYNAMICS
Duration : 90 Minutes

Semester : III
Course Code : 21ME34
Date : 30/11/2022
Max Marks : 20

Note: Answer ONE full question from each part.

K-Levels: K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
PART-A				
1(a)	A fluid at a pressure of 3bar and with volume 0.18m^3 contained in a cylinder below the piston which expands reversibly to a pressure of 0.6 bar according to $PV^2 = \text{Constant}$. Calculate the work done by the fluid on the piston.	4	CO3	K3
(b)	A heat engine receives reversibly 420kJ/s of heat from a source at 327°C and rejects heat reversibly to a sink at 27°C . It rejects heat by the following hypothetical amounts (i) 210kJ/s and (ii) 315kJ. Find which of these represent reversible, irreversible and impossible.	4	CO3	K3
(c)	Develop a linear temperature scale 'B' where in ice point and normal human body temperature are assumed as two fixed points and assigned the value of 0° and 50° B. If the temperature of human body on Celsius scale is 36°C , obtain the relation between 'B' scale and Celsius scale	4	CO3	K3
OR				
2(a)	A spherical balloon of diameter 0.5m is initially having an inside pressure of 100kPa. Due to heating, the pressure inside the balloon increases to 400kPa during which the inside pressure varies inversely proportional to square of the diameter of balloon. Determine displacement work during this process.	4	CO3	K3
(b)	An inventor claims that his heat engine which work at the rate of one kilowatt and absorbs heat at the rate of 65kJ/min from a source at 1127°C , when the ambient temperature is 27°C . Identify whether his claim is possible?	4	CO3	K3
(c)	The readings t_A and t_B of two Celsius thermometers A and B agree at ice & steam point, but elsewhere are related by the equation $t_A = L + Mt_B + Nt_B^2$ where L, M, N are constants, when both thermometers are immersed in a system of fluid, A registers 11°C while B registers 10°C . Solve for the reading on A when B registers 37.4°C	4	CO3	K3
PART -B				
3(a)	Distinguish between (i) path and point function (ii) Work and Heat	4	CO1	K2
(b)	With a neat PV diagram, illustrate an expression for work done for isothermal process and isobaric process by deriving from fundamentals.	4	CO1	K2
OR				
4(a)	Explain thermodynamic equilibrium.	4	CO1	K2
(b)	Explain carnot heat pump and reversible heat engine	4	CO1	K2

Name & Signature of
Course In charge
Dr. Nagaprasad KS

Name & Signature of
Module Coordinator
Dr. Nagaprasad KS

Name & Signature of
HOD ME

Name & Signature of
Principal



K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
1 SESSIONAL TEST 2022 - 23(ODD SEMESTER)

SCHEME AND SOLUTION (SET B)

Degree : BE
Branch : ME
Course Title : THERMODYNAMICS

Semester : III
Course Code : 21ME34
Max Marks : 20

Q. No	SOLUTION	MARKS
<u>PART-A</u>		
1(a)	Sketch; $W = 621.76\text{kJ}$	01 +03= 04
1(b)	(i) Reversible; (ii) Impossible	02 +03=04
1(c)	'B' scale expression $t = 4.6 t(B)$	02+ 02=04
2 (a)	$V = C/D^2$; $W = - 6.54\text{kJ}$	02+ 02=04
2(b)	Efficiency = 56% Ans: possible	02+ 02 = 04
2(c)	$M = 11.053$; $N = -0.00005364$	01+ 03=04
<u>PART-B</u>		
3 (a)	Explain depends on end points; Driving force is temperature;	02+ 02 = 04
3(b)	Sketch; $W = 0$; $W = (P_1 V_1 - P_2 V_2)/n-1$	01+ 03 = 04
4(a)	Explain thermal, mechanical equilibrium; Explain chemical, phase equilibrium	02+ 02= 04
4(c)	Carnot heat pump sketch+explanation; Carnot refrigerator sketch+explanation	02+ 02= 04


Signature of Course In-charge


Module In-charge


Head of the Department



K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
SECOND INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: A

USN

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Degree : B. E.
Branch : Mechanical Engineering
Course Title : THERMODYNAMICS
Duration : 60 Minutes

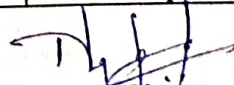
Semester : III
Course Code : 21ME34
Date : 11/01/2023
Max Marks : 20

Note: 1. Answer ONE full question from each part.


2. Use of Thermodynamic Data Hand Book is permitted

K-Levels: K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

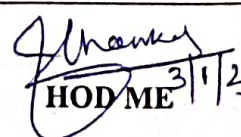
Q No.	Questions	Marks	CO	K-Level
PART-A				
1(a)	In an air standard diesel cycle, the compression ratio is 16. At the beginning of compression, temperature is 15 °C and pressure is 0.1 MPa. Heat is added until the temperature at end of constant pressure process is 1480 °C. Calculate: cut-off ratio, heat supplied per kg of air and cycle efficiency.	6	CO4	K3
(b)	A Rankine cycle operates between a pressure of 80 bar and 0.1 bar. The maximum cycle temperature is 600°C. If the steam turbine and condensate pump efficiency are 0.9 and 0.8 respectively, calculate net specific work output and thermal efficiency.	6	CO5	K3
OR				
2(a)	With the help of P-V and T-S diagrams, derive an expression for the air standard efficiency of diesel cycle. Also state the assumptions made	6	CO4	K3
(b)	Steam at 20 bar is expanded in a steam turbine to a pressure of 0.08bar. The saturated vapour enters the condenser, calculate efficiency of Rankine cycle. If the turbine and pump efficiency are 80% and 70%, calculate efficiency.	6	CO5	K3
PART -B				
3(a)	Why is Carnot cycle not a realistic model for steam power plants? Explain with approaches using T-S diagram	4	CO2	K2
(b)	Illustrate to find value for specific volume of CO ₂ at 200°C and 160 bar pressure by Vander wall's equation, Compressibility chart and Ideal gas equation.	4	CO2	K2
OR				
4(a)	Compare Otto and Diesel cycles, with PV & T-S diagrams, explain (i) maximum pressure & temperature are same (ii) compression ratio & heat addition are same	4	CO2	K2
(b)	Explain; Law of corresponding states, Reduced properties, Compressibility factor, Perfect gas equation, Limitation of Vander Waal's equation	4	CO2	K2


Name & Signature of
Course In charge

(Dr. Nagaprasad KS)


Name & Signature of
Module Coordinator

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HOD ME 3/1/23


Principal




K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
II SESSIONAL TEST 2022 - 23(ODD SEMESTER)

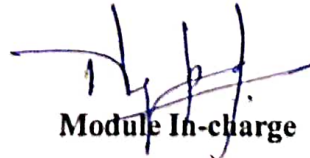
SCHEME AND SOLUTION (SET A)

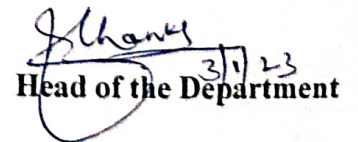
Degree : BE
Branch : ME
Course Title : THERMODYNAMICS

Semester : III
Course Code : 21ME34
Max Marks : 20

Q. No	SOLUTION	MARKS
	<u>PART-A</u>	
1(a)	Cutoff ratio = 1.169 Q = 223.6 kJ/kg, efficiency = 66%	02 +04= 06
1(b)	W _{net} = 791.1 kJ/kg, efficiency = 30.3%	03 +03=06
2 (a)	PV diagram; Derivation	02+ 04=06
2(b)	Rankine efficiency = 31% Efficiency = 28.6%	03+ 03 = 06
	<u>PART-B</u>	
3 (a)	Explain; T-S diagram;	02+ 02 = 04
3(b)	$v = 0.135 \text{ kg/m}^3$; $v = 0.1289 \text{ kg/m}^3$; $v = 0.1278 \text{ kg/m}^3$	01+ 03 = 04
4(a)	Explain; P-V & T-S diagram;	01+ 03= 04
4(c)	Explanation each 1 mark	02+ 02= 04


Signature of Course In-charge


Module In-charge


Head of the Department
3/1/23



K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
SECOND INTERNAL TEST QUESTION PAPER 2022-23ODDSEMESTER

KSIT

SET: B

USN

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Degree : B.E.
 Branch : Mechanical Engineering
 Course Title : THERMODYNAMICS
 Duration : 60 Minutes

Semester : III
 Course Code : 21ME34
 Date : 11/01/2023
 Max Marks : 20

Note: 1. Answer **ONE** full question from each part
 2. Use of Thermodynamic Data Hand Book is permitted

K-Levels: K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Ma rks	CO	K- Level
PART-A				
1(a)	Two engines are to operate on Otto and Diesel cycle with the following data. Exhaust temperature: 700 K; Maximum temperature: 1400K. State of air at the beginning of compression 0.1MPa, 300K. Estimate the compression ratio, efficiencies & rate of work output	6	CO4	K3
1(b)	A steam power station uses the following cycle: Steam at boiler outlet- 150bar, 550 ⁰ C, Reheat at 40 bar to 550 ⁰ C, Condenser at 0.1 bar. Using the Mollier chart and assuming ideal processes, find: i) quality at turbine exhaust ii) cycle efficiency iii) steam rate.	6	CO5	K3
OR				
2(a)	The minimum and maximum temperatures in an engine working on constant pressure cycle are 300K and 1500K and the heat addition during combustion is 500KJ/Kg of air. Another engine working on semi Diesel cycle between the same temperature limits has a heat addition of 500 KJ/Kg of air which is shared equally between the two heat addition processes. Compare their efficiencies and work outputs	6	CO4	K3
2(b)	A cyclic steam power plant is to be designed for a steam temperature at turbine inlet of 360 ⁰ C and an exhaust pressure of 0.08 bar. After isentropic expansion of steam in the turbine, the moisture content at the turbine exhaust is not to exceed 15%. Calculate Rankine cycle efficiency. Estimate also the mean temperature of heat addition.	6	CO5	K3
PART -B				
3(a)	With the help of T-S diagram, explain the working of Rankine cycle with regeneration using (i) Open feed water heater and (ii) closed feed water system cascaded backward type	4	CO2	K2
3(b)	Relate the values of pressure exerted by CO ₂ in a container of 1.5 m ³ capacity when it contains 5kg at 27 ⁰ C, by using Ideal gas equation, Vander Waal's equation and compressibility chart.	4	CO2	K2
OR				
4(a)	Explain the effect of following on Rankine cycle efficiency: i) Boiler pressure ii) Super heating iii) Condenser pressure	4	CO2	K2
4(b)	Explain; Law of corresponding states, Reduced properties, Compressibility factor, Perfect gas equation, Limitation of Vander Waal's equation.	4	CO2	K2

Name & Signature of
 Course In charge
 (Dr. Nagesh Prasad KS)

Name & Signature of
 Module Coordinator
 (Dr. Nagesh Prasad KS)

[Signature]
 31/1/23
 HOD ME

[Signature]
 Selected Principal



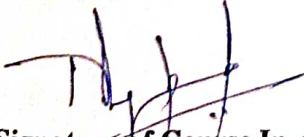
K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
II SESSIONAL TEST 2022 - 23(ODD SEMESTER)

SCHEME AND SOLUTION (SET B)

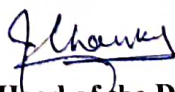
Degree : BE
Branch : ME
Course Title : THERMODYNAMICS

Semester : III
Course Code : 21ME34
Max Marks : 20

Q. No	SOLUTION	MARKS
	<u>PART-A</u>	
1(a)	Sketch; $W = 621.76\text{kJ}$	01 +03= 04
1(b)	(i) Reversible; (ii) Impossible	02 +03=04
2 (a)	$V = C/D^2$; $W = - 6.54\text{kJ}$	02+ 02=04
2(b)	Efficiency = 56% Ans: possible	02+ 02 = 04
	<u>PART-B</u>	
3 (a)	Explain depends on end points; Driving force is temperature;	02+ 02 = 04
3(b)	Sketch; $W = 0$; $W = (P_1 V_1 - P_2 V_2)/n-1$	01+ 03 = 04
4(a)	Explain thermal, mechanical equilibrium; Explain chemical, phase equilibrium	02+ 02= 04
4(c)	Carnot heat pump sketch+explanation; Carnot refrigerator sketch+explanation	02+ 02= 04


Signature of Course In-charge


Module In-charge


Head of the Department
3/1/23



K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
THIRD TEST QUESTION PAPER 2022-23 ODD SEMESTER

KSIT

SET: A

USN

Degree : B. E.
Branch : Mechanical Engineering
Course Title : THERMODYNAMICS
Duration : 60 Minutes

Semester : III
Course Code : 21ME34
Date : 29/03/2023
Max Marks : 20

Note: 1. Answer ONE full question from each part.

2. Use of Thermodynamic Data Hand Book is permitted

K-Levels: K1-Remembering, K2-Understanding, K3-Appling, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
PART-A				
1(a)	Show that entropy is a property of the system.	4	CO4	K3
(b)	A sample of fuel has following composition by weight. Carbon = 83%; Hydrogen = 11%; Oxygen = 3%; Nitrogen = 2%. Determine the stoichiometric air-fuel ratio	8	CO5	K3
OR				
2(a)	State and prove Clausius inequality.	4	CO4	K3
(b)	Methane is burned with atmospheric air. The analysis of products of combustion on dry basis is as follows; CO ₂ = 10%, O ₂ = 2.37%, CO = 0.53%, N ₂ = 87.7%. Determine the combustion equation and air-fuel ratio on mass basis.	8	CO5	K3
PART-B				
3	Define stoichiometric air-fuel ratio, enthalpy of formation and enthalpy of combustion	8	CO2	K2
OR				
4	Define adiabatic flame temperature, combustion efficiency and percentage excess air.	8	CO2	K2

Name & Signature of
Course In charge

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Module Coordinator

CD. Nagaprasad KS

21/3/23
HOD ME

Principal

Selected



K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
THIRD TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: B

USN

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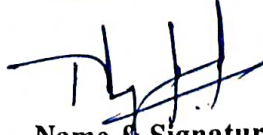
Degree : B. E.
Branch : Mechanical Engineering
Course Title : THERMODYNAMICS
Duration : 60 Minutes

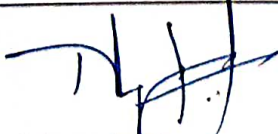
Semester : III
Course Code : 21ME34
Date : 29/03/2023
Max Marks : 20


Note: 1. Answer ONE full question from each part.
2. Use of Thermodynamic Data Hand Book is permitted

K-Levels: K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
PART-A				
1(a)	Prove that for system executing a cyclic process $\oint \frac{\delta Q}{T} \leq 0$.	4	CO4	K3
(b)	The products of combustion of unknown fuel C_xH_y have the following composition measured by an Orsat apparatus $CO_2 = 8\%$, $O_2 = 8.8\%$, $CO = 0.9\%$, $N_2 = 82.3\%$. Determine the combustion equation and air-fuel ratio on mass basis.	8	CO5	K3
OR				
2(a)	Show that entropy is a property of system.	4	CO4	K3
(b)	Benzene C_6H_6 is burnt in air and the analysis of products of combustion yielded the following results. $CO_2 = 10.96\%$, $O_2 = 7.5\%$, $CO = 0.5\%$, $N_2 = 81.04\%$. Determine the air-fuel ratio on mass basis and percentage excess air..	8	CO5	K3
PART -B				
3	Define enthalpy of formation, enthalpy of reactants and enthalpy of combustion	8	CO2	K2
OR				
4	With a neat sketch, explain the exhaust gas analysis using Orsat apparatus	8	CO2	K2


Name & Signature of
Course In charge
(Dr. Nagaprasad KS)


Name & Signature of
Module Coordinator
(Dr. Nagaprasad KS)


HOD ME 21/3/23


Principal