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

SET: A

USN | | | | | | | | | |

Degree	:	**B. E.**	**Semester**	:	**III**
Branch	:	**Mechanical Engineering**	**Course Code**	:	**21ME34**
Course Title	:	**THERMODYNAMICS**	**Date**	:	**30/11/2022**
Duration	:	**90 Minutes**	**Max Marks**	:	**20**

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

K-Levels: K1-Remebering, 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 – 5 V, 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 (0^0C) and Normal human body temperature (37^0C) were 0^0N and 12^0N 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 its expands reversibly for the following cases (i)At a constant pressure to a final volume of 0.2m^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 deviced 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** carnot 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
	PART-A	
1(a)	W = - 150kJ $V_2 = 0.35m^3$	01 +03= 04
1(b)	$Q_2 = 0.78Q_1$; Ans: 1.81	01 +03=04
1(c)	Newton scale expression t = 3 t(N)	02+ 02=04
2 (a)	W = - 5.75kJ V_2 = -2.25kJ	02+ 02=04
2(b)	Efficiency = 75% Ans: Impossible	02+ 02 = 04
2(c)	Ro = 11 ohm; A = 1.353; B = -2.64	01+ 03=04
	PART-B	
3 (a)	Ecplain 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+explaination; 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.,**	**Semester**	:	**III**
Branch	:	**Mechanical Engineering**	**Course Code**	:	**21ME34**
Course Title	:	**THERMODYNAMICS**	**Date**	:	**30/11/2022**
Duration	:	**90 Minutes**	**Max Marks**	:	**20**

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

K-Levels: K1-Remebering, 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 = 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^{0}C and rejects heat reversibly to a sink at 27^{0}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 0^0 Band 50^0 B. If the temperature of human body on Celsius scale is 36^{0}C, **obtain** the relation between 'B' scale and Celsius sale	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 ^{0}C, when the ambient temperature is 27^{0}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^{0}C while B registers 10^{0}C. **Solve** for the reading on A when B registers 37.4^{0}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	Name & Signature of Module Coordinator	HOD ME	Principal
(Dr. Nagaprasad KS)	(Dr. Nagaprasad KS)		

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

I 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
	PART-A	
1(a)	Sketch; W = 621.76kJ	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 = - 6.54kJ	02+ 02=04
2(b)	Efficiency = 56% Ans: possible	02+ 02 = 04
2(c)	M = 11.053; N = -0.00005364	01+ 03=04
	PART-B	
3 (a)	Explain depends on end points; Driving force is temperature;	02+ 02 = 04
3(b)	Sketch; W= 0; $W = (P_1V_1-P_2V_2)/n-1$	01+ 03 = 04
4(a)	Explain thermal, mechanical eqillibrium; Explain chemical, phase eqillibrium	02+ 02= 04
4(c)	Carnot heat pump sketch+explaination; Carnot refrigerator sketch+explaination	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 | | | | | | | | | | |

Degree	:	**B. E.**	**Semester**	:	**III**
Branch	:	**Mechanical Engineering**	**Course Code**	:	**21ME34**
Course Title	:	**THERMODYNAMICS**	**Date**	:	**11/01/2023**
Duration	:	**60 Minutes**	**Max Marks**	:	**20**

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

K-Levels: K1-Remebering, 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 ^{0}C and pressure is 0.1 MPa. Heat is added until the temperature at end of constant pressure process is 1480 ^{0}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^{0}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^{0}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 K S)

Name & Signature of Module Coordinator (Dr. Nagaprasad K S)

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 | **Semester : III**
Branch : ME | **Course Code : 21ME34**
Course Title : THERMODYNAMICS | **Max Marks : 20**

Q. No	SOLUTION	MARKS
	PART-A	
1(a)	Cutoff ratio = 1.169 Q = 223.6 kJ/kg, effeciency = 66%	02 +04= 06
1(b)	Wnet = 791.1 kJ/kg, effeciency = 30.3%	03 +03=06
2 (a)	PV diagram; Derivation	02+ 04=06
2(b)	Rankine efficiency = 31% Efficiency = 28.6%	03+ 03 = 06
	PART-B	
3 (a)	Ecplain; T-S diagram;	02+ 02 = 04
3(b)	v = 0135 kg/m^3; v = 0.1289 kg/m^3; v = 0.1278 kg/m^3	01+ 03 = 04
4(a)	Ecplain; P-V &T-S diagram;	01+ 03= 04
4(c)	Explaination each 1 mark	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 2022-23ODDSEMESTER

SET: B

USN | | | | | | | | | | |

Degree	:	**B.E.**	**Semester**	:	**III**
Branch	:	**Mechanical Engineering**	**Course Code**	:	**21ME34**
Course Title	:	**THERMODYNAMICS**	**Date**	:	**11/01/2023**
Duration	:	**60 Minutes**	**Max Marks**	:	**20**

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

2. Use of Thermodynamic Data Hand Book is permitted

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

Q No.	Questions	Marks	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
(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
(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
(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
(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 (Dr. Nagaprasad KS)

3/1/23

HOD ME

Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

II SESSIONAL TEST 2022 – 23(ODD SEMESTER)

SCHEME AND SOLUTION (SET B)

Degree : BE | **Semester : III**
Branch : ME | **Course Code : 21ME34**
Course Title : THERMODYNAMICS | **Max Marks : 20**

Q. No	SOLUTION	MARKS
	PART-A	
1(a)	Sketch; W = 621.76kJ	01 +03= 04
1(b)	(i) Reversible; (ii)Impossible	02 +03=04
2 (a)	$V = C/D^{2;}$ W = - 6.54kJ	02+ 02=04
2(b)	Efficiency = 56% Ans: possible	02+ 02 = 04
	PART-B	
3 (a)	Explain depends on end points; Driving force is temperature;	02+ 02 = 04
3(b)	Sketch; W= 0; $W = (P_1V_1-P_2V_2)/n-1$	01+ 03 = 04
4(a)	Explain thermal, mechanical eqillibrium; Explain chemical, phase eqillibrium	02+ 02= 04
4(c)	Carnot heat pump sketch+explaination; Carnot refrigerator sketch+explaination	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

SET: A

USN | | | | | | | | | | |

Degree	:	**B. E.**	**Semester**	:	**III**
Branch	:	**Mechanical Engineering**	**Course Code**	:	**21ME34**
Course Title	:	**THERMODYNAMICS**	**Date**	:	**29/03/2023**
Duration	:	**60 Minutes**	**Max Marks**	:	**20**

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

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, 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 (Dr. Nagaprasad KS)

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

HOD ME 21/3/23

Principal

Selected

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

KSIT

SET: B

USN | | | | | | | | | | |

Degree	:	B. E.	Semester	:	III
Branch	:	Mechanical Engineering	Course Code	:	21ME34
Course Title	:	THERMODYNAMICS	Date	:	29/03/2023
Duration	:	60 Minutes	Max Marks	:	20

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

K-Levels: K1-Remebering, 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