19ME3402-APPLIED THERMODYNAMICS

Offering Branches	ME		
Course category:	Program Core	**Credits**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
Prerequisites	19ME3302 -Engineering Thermodynamics	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Learn the terminology, basic concepts and working principles of IC engines.	L1
CO2	Understand the various stages of combustion process in SI and CI engines.	L2
CO3	Analyze thermodynamic analysis of Rankine cycle.	L3
CO4	Assess thermodynamic analysis of gas power cycles.	L4
CO5	Evaluate the COP of refrigeration systems and understand various Psychometric processes.	L3

Course Content		
UNIT-1	**IC Engines:** Working and classification of IC engines, comparison of two stroke and four stroke engines, comparison of SI and CI Engines. **Testing and Performance of IC Engines:** Methods of testing IC Engines, performance analysis of IC Engines.	**CO1**
UNIT-2	**Combustion in IC Engines: SI engine**: stages of combustion, normal combustion, abnormal combustion, variables affecting delay period and knocking, pre-ignition. S**tages of combustion in CI engine**: normal combustion, abnormal combustion, variables affecting delay period and knocking. Fuel requirements and fuel rating of SI and CI engines.	**CO2**
UNIT-3	**Vapour Power Cycles:** Vapour power cycle, simple Rankine cycle, mean temp of heat addition thermodynamic variables affecting efficiency and output of Rankine cycle. **Methods to improve thermal efficiency of Rankine cycle:** Reheating, Regeneration, Factors affecting Rankine cycle, Adiabatic flame temperature.	**CO3**
UNIT-4	**Gas power Cycle:** Brayton cycle, Simple gas turbine plant, closed cycle and open cycle for gas turbines, condition for maximum pressure ratio and optimum pressure ratio, actual cycle.	**CO4**
UNIT-5	**Refrigeration:** Bell-Coleman cycle-vapour compression cycle,	**CO5**

	affect of vapour condition on COP of VCR, vapour absorption cycle, properties of common refrigerants. **Principles of Psychrometry and Air Conditioning:** Psychometric terms, psychometric processes and air conditioning systems	
Learning Resources		
Text books:	1. Ganesan V/ Internal Combustion Engines / Tata McGraw Hill,2017. 2. CP Arora / Refrigeration and Air Conditioning / TMH. 3. V.P.Vasandani and D.S.Kumar / Treatise on Heat Engineering / Metropoliton book Co. Pvt. Ltd.	
Reference books	1. Mahesh M Rathore, Thermal Engineering, McGraw Hill Publications - 2012. 2. CengalY.AandBolesM.A,Thermodynamics:AnEngineeringApproach,5/e,McGraw-Hill, 2006. 3. Yahya,S.M.,Turbines,CompressorsandFans,4/e,TataMcGrawHill,2010. 4. Nag P.K, Engineering Thermodynamics, 4/e, Tata McGraw-Hill,2008. 5. Onkar Singh, Thermal Turbomachines, 3/e, Wiley India,2014. 6. P.L.Ballaney, Thermal Engineering, 2/e, Khanna,2005.	

Course coordinator **HOD**

Code No:**19ME3402**

PVP19

PVP SIDDHARTHA INSTITUTE OF TECHNOLOGY
(Autonomous)
II.B.Tech – II Semester Model Paper
APPLIED THERMODYNAMICS

(ME)

Duration:3 Hours **Max Marks:70**

Note: 1. This question paper contains two papers Part A and B.
2.Part A is compulsory which carries 10 marks. Answer all questions in part A.
3.Part B consists of 5 units. Answer any one full question from each unit.
Each question carries 12 marks and may have a, b, c as sub questions.
4.All parts of question paper must be answered in one place.

PART-A

5×2=10 Marks

		Blooms Level	CO
1.a)	What are the main components of an I.C engine?	1	**CO1**
1.b)	Write note on rating of fuels in SI and CI engine.	1	**CO2**
1.c)	Draw the Rankine cycle on T-S diagram.	1	**CO3**
1.d)	What are the components of gas turbine plant?	1	**CO4**
1.e)	Define specific humidity and relative humidity.	1	**CO5**

PART-B

5×12=60 Marks

			Blooms Level	CO	Max. Marks
UNIT-I					
2	a	Explain the working of 4-stroke Diesel engine with a neat sketch.	2	**CO1**	6
	b	Distinguish between SI and CI Engines.	2	**CO1**	6
OR					
3	a	A four-cylinder engine running at 1200 rpm delivers 20KW.The average torque when one cylinder was cut is110 Nm. Find the indicated thermal efficiency if the calorific value of the fuel is 43MJ/kg and the engine uses 360 grams of gasoline per KWhr.	3	CO1	6
	b	Explain the method of testing an I.C. Engine working diesel cycle.	2	CO1	6
UNIT-II					
4	a	What are different stages of combustion in CI Engine? And explain with p-θ diagram.	2	**CO2**	6
	b	What is delay period and what factors affect the delay period in CI engines ?.	2	**CO2**	6
OR					
5	a	Explain normal and abnormal combustion in CI engines?	2	**CO2**	6
	b	Write short on Octane Number and Cetane Number.	1	**CO2**	6
UNIT-III					
6	a	Derive an expression for Rankine cycle efficiency and also draw the P-V, h-s and T-S diagrams.	3	**CO3**	6

	b	What are the factors affecting Rankine cycle?	2	**CO3**	6
		OR			
7		Steam is working fluid in a Rankine cycle with super heat and reheat steam enters at Iststage of turbine 8MPa and 480^{0}C and expanded to 0.7Mpa. It is then reheated to 440^{0}C before entering the second stage turbine at 0.7Mpa and 440^{0}C. Where it expands to a condenser pressure of 0.008Mpa. The net power output is 100MW. Determine thermal efficiency of the cycle, mass flow rate of steam in Kg/hr, rate of heat transfer from the condensing steam as it passes through the condenser in MW**.**	3	**CO3**	12
		UNIT-IV			
8	a	Explain about the open cycle and closed cycle turbines with neat sketches and also draw P- V and T-S diagrams.	2	**CO4**	6
	b	Derive the optimum pressure for maximum efficiency of simple gas turbine cycle.	3	**CO4**	6
		OR			
9		A gas turbine unit has a pressure ratio of 6:1 and maximum cycle temperature of 610^{0}C. The isentropic efficiencies of the compressor and turbine are 0.80 and 0.82 respectively. Air enters the compressor at 15^{0}C at the rate of 16kg/s. Calculate i) work required for compression ii) power developed by the turbine iii) Net power output in kilowatts Take Cp=1.005 kJ/kgk and γ=1.4 for the compression process, and take Cp=1.11 kJ/kgk and γ=1.333 for the expansion process.	3	**CO4**	12
		UNIT-V			
10	a	An air refrigerator system operating on Bell Coleman cycle takes in air from cold room at 268 K and compresses it from 1 bar to 5.5 bars, the index of compression being 1.25. The compressed air is cooled to 300 K. The ambient temperature is 20ºC. Air expands in expander where the index of expansion is 1.35. Calculate: 8 M i) COP of the system and ii) Quantity of air circulated per minute for production of 1500 kg of ice per day at 0°C from water at 20ºC. iii) Capacity of the plant.	3	**CO5**	6
	b	Explain the working of a simple VCR System with a neat sketch.	2	**CO5**	6
		OR			
11	a	A Sling psychomotor reads 40^0 C dry bulb temperature and 28^0 C wet bulb temperature. Calculate the following: i) Specific humidity; ii) Relative humidity; iii) vapour density in air; iv) Dew point temperature; v) Enthalpy of mixture per kg of dry air.	2	**CO5**	6
	b	Explain the following processes. i) Sensible Cooling, ii) Sensible heating and iii) Humidification and Dehumidification process.	2	**CO5**	6

Course coordinator **HOD**

Miro Syllabus

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UNIT-5	**Refrigeration:** Bell-Coleman cycle-vapour compression cycle, affect of vapour condition on COP of VCR, vapour absorption cycle, properties of common refrigerants. **Principles of Psychrometry and Air Conditioning:** Psychometric terms, psychometric processes (Sensible heating, Sensible cooling, Humidification and Dehumidification) and air conditioning systems (Summer air conditioning system only)	**CO5**
Learning Resources		
Text books:	4. Ganesan V/ Internal Combustion Engines / Tata McGraw Hill,2017. 5. CP Arora / Refrigeration and Air Conditioning / TMH. 6. V.P.Vasandani and D.S.Kumar / Treatise on Heat Engineering / Metropoliton book Co. Pvt. Ltd.	
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