



Department of Mechanical Engineering
Raajdhani Engineering College, Bhubaneswar, Odisha-751017

LESSON PLAN

Faculty Name	Ayushman Nayak			Name of the Program	Diploma in Mechanical Engineering
Course Name	Thermal Engineering (I)			Course Code	TH-4 / (C204)
Course Year	2nd year	Semester	3rd	Academic Period	2023-24
No. of Classes allotted per Week		04	Planned Classes Required to Complete the Course		60

Sl. No.	Topics to be covered	Module	No. of hours Required	Mode of Teaching	CO	BOOK	CHAPTER(PAGES)	OTHER SOURCE(IM)
1	Define Thermodynamics. Define System, surroundings and boundary. Explain open closed and isolated system.	I	1	LM/ IM	CO1	T1 T2	T1 : 1–15 T2 :-	https://www.youtube.com/watch?v=jeQT7JlgtJc&pp=ygVpRGVmaW5lCVRoZXJtb2R5bmFtaWNzLglEZWZpbmUgU3lzdGVtLCBzdXJyb3VuZGluZ3MgYW5kIGJvdW5kYXJ5LiBFebHBsYWluIG9wZW4gY2xvc2VkIGFuZCBpc29sYXRIZCBzeXN0ZW0u
2	Define Intensive and extensive properties. Differentiate between homogeneous and heterogeneous system.	I	1	LM/ IM	CO1	T1 T2	T1 : 1–15 T2 :-	https://www.youtube.com/watch?v=fyZm2rxeYWU&pp=ygVoRGVmaW5lCUludGVuc2l2ZQlhbmqjZxh0ZW5zaXZlIHByb3BlcnRpbmU1ERpZmZlcmVudGlhdGUJYmV0d2VlbiBob21vZ2VuZW91cyBhbmQgICBoZXRIcm9nZW51b3VzIHNS43RlB4S4%3D
3	Define Microscopic and macroscopic approach of	I	1	LM/ IM	CO1	T1	T1 : 1–15 T2:	https://www.youtube.com/watch?v=Phwii1GehE&pp=ygVvRGVmaW



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	thermodynamics.					T2		5IIE1pY3Jvc2NvcGljIGFuZCBtYWNyb3Njb3BpYyBhcHBByb2FjaCBvZiB0aGVybw9keW5hbWljcy4gRXhwbGFpbiBDb250aW51dW0gQXBwcm9hY2gsIFF1YXNpLXN0YXRpYyBwcm9jZXNz
4	Explain Continuum Approach, Quasi-static process	I	1	LM/ IM	CO1	T1 T2	T1 : 12 T2 :	https://www.youtube.com/watch?v=tlQzJoJfTIA&pp=ygVvRGVmaW51IE1pY3Jvc2NvcGljIGFuZCBtYWYyYyBhcHBByb2FjaCBvZiB0aGVybw9keW5hbWljcy4gRXhwbGFpbiBDb250aW51dW0gQXBwcm9hY2gsIFF1YXNpLXN0YXRpYyBwcm9jZXNz
5	Thermodynamic properties of a system (Pressure, volume, temperature and units of measurement).	I	1	LM/ IM	CO1	T1 T2	T1 : 10 T2 :-	https://www.youtube.com/watch?v=zpOK4wjC4h4&pp=ygVeVGhlcm1vZHluYW1pYyBwcm9wZXJ0aWVzIG9mIGEgc3lzdGVtChQcmVzc3VyZSwgdm9sdW1lLCB0ZW1wZXJhdHVyZSBhbmQgdW5pdHMgb2YgbWVhc3VyZW1lbnQpLg%3D%3D
6	Define thermodynamic State, path, process and Cycle.	I	1	LM/ IM	CO1	T1 T2	T1 : 10 T2 :	https://www.youtube.com/watch?v=YKDt_1XGvve&pp=ygVoRGVmaW51IHRoZXJtb2R5bmFtaWMgU3RhdGUuSIBhdGgsIHByb2Nlc3MgYW5kIEN5Y2xlLkRlZmluZSB0aGVybw9keW5hbWljIFN0YXRILCBwYXRoLCBwcm9jZXNzIGFuZCBDeWNsZS4%3D
7	Explain Thermodynamic equilibrium i.e. thermal mechanical and chemical equilibrium.	I	1	LM/ IM	CO1	T1	T1 : 11 T2:	https://www.youtube.com/watch?v=TTjZIU1CSrQ&pp=ygVSRXhwbGFpbiBUaGVybw9keW5hbWljIGV



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						T2		xdWlSaWJyaXVtIGkuZS4gdGhlc 1hbCBtZWNNoYW5pY2FsIGFuZC BjaGVtaWNhbCBlcXVpbGlicml1b Q%3D%3D
8	Conceptual explanation of energy and its sources.	I	1	LM/ IM	CO1	T1 T2	T1 : 14 T2:	https://www.youtube.com/watch?v=Zgp86PVXXuQ&pp=ygUxQ29uY2VwdHVhbCBleHBsYW5hdGlvbiBvZiBlbmVyZ3kgYW5kIGl0cyBzb3VyY2VzLg%3D%3D
9	Explain work and heat, their relation, units and Work transfer,	I	1	LM/ IM	CO1	T1 T2	T1 : 41 T2:	https://www.youtube.com/watch?v=WMWeJN-nYYE&pp=ygU_RXhwbGFpbiB3b3JrIGFuZCB0ZWl0CB0aGVpciBvZWxhdGlvbiwgdW5pdHMgYW5kIFdvcmsgdHJhbnNmZXIs
10	Derive the formula for the work done in a closed system.	I	1	LM/ IM	CO1	T1 T2	T1 : 42-53 T2:	https://www.youtube.com/watch?v=ZbRXxg6pGL0&pp=ygU4RGVyaXZlIHRob2SBmb3JtdWxhIGZvciB0aGUgd29yayBkb25lIGluIGEGY2xvc2VkiHN5c3RlbnS4%3D
11	Solve the numerical on work done in a closed system.	I	1	LM/ IM	CO1	T1 T2	T1 : 42-53 T2:	
12	Explain Mechanical equivalence of heat and Differentiate between heat and work.	II	1	LM/ IM	CO2	T1 T2	T1 : 42-53 T2:	https://www.youtube.com/watch?v=nRACs9K51To&pp=ygVPRXhwbGFpbiBNZWNNoYW5pY2FsIGVxdWl2YWxlbnNIIG9mIGh1YXQgYW5kIERpZmZlcmVudGhhdGUgYmV0d2VlbiBoZWl0IGFuZCB3b3JrLg%3D%3D
13	State and explain Zeroth law and First law of thermodynamics. Limitation of First law..	II	1	LM/ IM	CO2	T1 T2	T1 : 26,69 T2 :	https://www.youtube.com/shorts/PSuVydHq2Ck



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14	Application of first law for flow process. Derivation of steady flow energy equation.	II	1	LM/ IM	CO2	T1 T2	T1 : 71 T2 :	https://www.youtube.com/watch?v=5QRllnFLOyQ&pp=ygVVQXBwbGljYXRpb24gb2YgZmlyc3QgbGF3IGZvciBmbG93IHByb2Nlc3MuIERlcm12YXRpb24gb2Ygc3RIYWR5IGZsb3cgZW5lcmd5IGVxdWFOaW9uLg%3D%3D
15	Application of SFEE in Nozzle Turbine and Compressor.	II	1	LM/ IM	CO2	T1 T2	T1 : 87 T2:	https://www.youtube.com/watch?v=1FiRshwKcwA&pp=ygU1QXBwbGljYXRpb24gb2YgU0ZFRSBpbIBOb3p6bGUgVHVyYmluZSBhbmQgQ29tcHJlc3Nvci4%3D
16	Application of SFEE in Nozzle Turbine and Compressor Numerical.	II	1	LM/ IM	CO2	T1 T2	T1 : 92-101 T2:	
17	Define Thermal reservoir. Concept of heat engine, heat pump and refrigerator.	II	1	LM/ IM	CO2	T1 T2	T1 : 120 T2:	https://www.youtube.com/watch?v=XeqyO50qVa0&pp=ygVNRGVmaW5lIFRoZXJtYWwgcmVzZXJ2b21yLiBDdb25jZXB0IG9mIGhlYXQgZW5naW5lLCBoZWFOIHB1bXAgYW5kIHJlZnJpZ2VyYXRvci4%3D
18	Statement of Second law of thermodynamics(Clausius and Kelvin Planck Statement)	II	1	LM/ IM	CO2	T1 T2	T1 : 121 T2 :-	https://www.youtube.com/watch?v=GC1fCvm0NMA&pp=ygVQU3RhdGVtZW50IG9mIFNlY29uZCBsYXcgb2YgdGhlcmlvZHUyW1pY3MgKENSXXVzaXVzIGFuZCBLZWx2aW4gUGxhbmNrlFN0YXRlbWVudCk%3D
19	Application of second law in heat engine, Refrigerator, and Heat Pump determination of efficiency.	II	1	LM/ IM	CO2	T1 T2	T1 : 121-122 T2:	https://www.youtube.com/watch?v=dDQgOvmSXCE&pp=ygViQXBwbGljYXRpb24gb2Ygc2Vjb25kIGxhdYBpbBoZWFOIGVvZ2luZSsgUmVmcmlnZXJhdG9yLjBhbmQgSGVhdCBQdW1wIGRldGVybWluYXRpb24gb2YgZWZmaWNpZW5jeS4%3D



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20	Solve the problem using Second law of Thermodynamics.	II	1	LM/ IM	CO2	T1 T2	T1 : 141 T2:	
21	Solve problem in Heat engine, heat pump and Refrigerator.	II	1	LM/ IM	CO2	T1 T2	T1 : 141 T2:	
22	Explain Laws of Perfect gas, Boyle's law, Charle's law, Avogadro's law.	III	1	LM/ IM	CO3	T1 T2	T1 : 320-340 T2:	https://www.youtube.com/watch?v=sqFKWJF0FHY&pp=ygVNRXhwbGFpbiBMYYXdzIG9mIFBlcmZlY3QgZ2FzLCBCb3lsZeKAmXMgbGF3LCBDbGFyYXJlZlZlIGxhdjYwQXZvZ2Fkcm_ljJlZlIGxhdjY4%3D
23	Dalton's law of Partial pressure, Gay-Lussac law, General gas equation	III	1	LM/ IM	CO3	T1 T2	T1 : 320-340 T2:	https://www.youtube.com/watch?v=XC1txxuEKhg&pp=ygVIRGFsdG9u4oCZcyBsYXcgb2YgUGFydGlhbCBwcmVzc3VyZSwgR2F5LUx1c3NhYyBsYXcsiEdlbnVyYWwgZ2FzIGVxdWF0aW9u
24	Explain Characteristic gas constant, Universal gas constant and define the relation between them.	III	1	LM/ IM	CO3	T1 T2	T1 : 320-340 T2:	https://www.youtube.com/watch?v=Run9ZdkGecY&pp=ygVhRXhwbGFpbiBDbGFyYWN0ZXJpc3RyYyBnYXMGY29uc3RhbnQsIFVuaXZlc nNhbCBnYXMGY29uc3RhbnQgY W5kIGRlZmluZSB0aGUGcmVsYX Rpb24gYmV0d2VlbiB0aGVtLg%3 D%3D
25	Define Enthalpy, Entropy, and Internal Energy of a Thermodynamic system.	III	1	LM/ IM	CO3	T1 T2	T1 : 76,157 T2 :	https://www.youtube.com/watch?v=ZnqmyAEI2UQ&pp=ygVJRGVma W5lIEVudGhhbHB5LzCBFbnRyb3 B5LzCBhbmQgSW50ZXJlYXVwR W5lcmdd5IG9mIGegIFRoZXJtb2R 5bmFtaWMgc3lzdGVtLg%3D%3D



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26	Enthalpy, Entropy, and Internal Energy of a Thermodynamic system numerical.	III	1	LM/ IM	CO3	T1 T2	T1 : 185 T2:	
27	Explain specific heat of gas (Cp and Cv) Relation between Cp & Cv	III	1	LM/ IM	CO3	T1 T2	T1 : 56 T2:	https://www.youtube.com/watch?v=tWcCIAKtRWA&pp=ygVBRXhwbGFpbiBzcGVjaWZpYyBoZWFOIG9mIGdhcyAoQ3AgYW5kiEN2KSBSZWxhdGlvbiBiZXR3ZWVuIENwICYgQ3Y%3D
28	Derive the work done during a non-flow process i.e. Isochoric, Isobaric.	III	1	LM/ IM	CO3	T1 T2	T1 : 48-53 T2 :	https://www.youtube.com/shorts/X-x5c9FwQS8
29	Application of first law in Isothermal, Isentropic and Polytropic Process.	III	1	LM/ IM	CO3	T1 T2	T1 : 48-53 T2:	
30	Classroom Problems	III	1	LM/ IM	CO3	T1 T2	T1 : 57-64	
31	Define & classify I.C engine	IV	1	LM/ IM	CO4	T1 T2	T1 : 508-515 T2 :	https://www.youtube.com/watch?v=cT9UN1XENnk&pp=ygUcRGVmaW5lICZgY2xhc3NpZnkgSS5DIGVuZ2luZQ%3D%3D
32	Terminology of I.C Engine	IV	1	LM/ IM	CO4	T1 T2	T1 : 508-515 T2:	
33	Explain the working principle of 4-stroke S.I engine and C.I engine.	IV	1	LM/ IM	CO4	T1 T2	T1 : 508-515 T2:	https://www.youtube.com/watch?v=XiYIdcLKEc&pp=ygVERXhwbGFpbiB0aGUgd29ya2luZyBwcm1uY2lwbGUgb2YgNC1zdHJva2UgUy5JIGVuZ2luZSBhbmQgQy5JIGVuZ2l



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								uZS4%3D
34	Explain the working principle of 4-stroke S.I engine and C.I engine.	IV	1	LM/ IM	CO4	T1 T2	T1 : 508-515 T2 :	https://www.youtube.com/watch?v=XiYIdcLKEc&pp=ygVERXhwbGFpbiB0aGUgd29ya2luZyBwcmLuY2lwbGUgb2YgNC1zdHJva2UgUy5JIGVuZ2luZSBhbmQgQy5JIGVuZ2luZS4%3D
35	Explain the working principle of 2-stroke S.I and C.I engine.	IV	1	LM/ IM	CO4	T1 T2	T1 :508-515 T2:	https://www.youtube.com/watch?v=iG1RMxecN3o&pp=ygU9RXhwbGFpbiB0aGUgd29ya2luZyBwcmLuY2lwbGUgb2YgMi1zdHJva2UgUy5JIGFuZCBDLkkgZW5naW5lLg%3D%3D
36	Differentiate between S.I and C.I engine.	IV	1	LM/ IM	CO4	T1 T2	T1 :508-515 T2:	https://www.youtube.com/watch?v=iG1RMxecN3o&pp=ygU9RXhwbGFpbiB0aGUgd29ya2luZyBwcmLuY2lwbGUgb2YgMi1zdHJva2UgUy5JIGFuZCBDLkkgZW5naW5lLg%3D%3D
37	Differentiate between 2-stroke & 4-stroke engine.	IV	1	LM/ IM	CO4	T1 T2	T1 : 508-515 T2 :	https://www.youtube.com/watch?v=iG1RMxecN3o&pp=ygU9RXhwbGFpbiB0aGUgd29ya2luZyBwcmLuY2lwbGUgb2YgMi1zdHJva2UgUy5JIGFuZCBDLkkgZW5naW5lLg%3D%3D
38	Classroom Problems	IV	1	LM/ IM	CO4	T1 T2	T1 : T2 :	
39	Explain the Carnot cycle with P-V and T-S diagram and derive the process involved in Carnotcycle.	V	1	LM/ IM	CO5	T1 T2	T1 : 504 T2 :	https://www.youtube.com/watch?v=SXDZr2O2g2s&pp=ygViRXhwbGFpbiB0aGUgQ2Fybm90IGN5Y2x1IHdpdGggUC1WIGFuZCBULVMg



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								ZGlhZ3JhbSBhbmQgZGVyaXZIIHRoZSBwcm9jZXNzIGludm9sdmVkiGluIENhcm5vdCBjeWNsZS4%3D
40	Derive the efficiency of Carnot cycle.	V	1	LM/ IM	CO5	T1 T2	T1 : 504	https://www.youtube.com/watch?v=PD18DWPuitc&pp=ygUmRGVyaXZIIHRoZSBIZmZpY2llbmN5IG9mIENhcm5vdCBjeWNsZS4%3D
41	Explain the Otto cycle with P-V and T-S diagram and derive the process involved.	V	1	LM/ IM	CO5	T1 T2	T1 : 508-514	https://www.youtube.com/watch?v=PB7n8Y74890&pp=ygVQRXhwbGFpbiB0aGUgT3R0byBjeWNsZSB3aXRoIFAtViBhbmQgVC1TIGRpYWdyYW0gYW5kIGRlcmI2ZSB0aGUgcHJvY2VzcyBpbmZvbHJlZC4%3D
42	Derive the efficiency of Diesel cycle.	V	1	LM/ IM	CO5	T1 T2	T1 : 515-516	https://www.youtube.com/watch?v=DLzM-PEwTXg&pp=ygUIRGVyaXZIIHRoZSBIZmZpY2llbmN5IG9mIERpZlNlbnCBjeWNsZQ%3D%3D
43	Diesel cycle numerical.	V	1	LM/ IM	CO5	T1 T2	T1 : 543	
44	Explain the Dual cycle with P-V and T-S diagram and derive the process involved in Dual cycle.	V	1	LM/ IM	CO5	T1 T2	T1 : 519 T2:	https://www.youtube.com/watch?v=4YC04Sylpso&pp=ygVerRXhwbGFpbiB0aGUgRHVhbCBjeWNsZSB3aXRoIFAtViBhbmQgVC1TIGRpYWdyYW0gYW5kIGRlcmI2ZSB0aGUgcHJvY2VzcyBpbmZvbHJlZCBpbjBEWFsIGN5Y2xlLg%3D%3D
45	Derive the efficiency of Dual cycle.	V	1	LM/ IM	CO5	T1 T2	T1 : 517 T2:	https://www.youtube.com/watch?v=rMRmJALRBhw&pp=ygUkRGVyaXZIIHRoZSBIZmZpY2llbmN5IG9mIERlYWwgY3ljbGUu



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46	Define Fuel and its types.	V	1	LM/ IM	CO5	T1 T2	T1 : T2:	https://www.youtube.com/watch?v=ShpyFsyZc14&pp=ygUZRGVmaW5lIEZlZWwgYW5kIGl0cyB0eXB1cw%3D%3D
47	Explain application of fuel.	VI	1	LM/ IM	CO6	T1 T2	T1 : T2:	https://www.youtube.com/watch?v=qX3t-r9mVdY&pp=ygUcRXhwbGFpbihhcHBsaWNhdGlvbivZiBmdWVsLg%3D%3D
48	Define Heating value of fuel.	VI	1	LM/ IM	CO6	T1 T2	T1 : T2:	https://www.youtube.com/watch?v=rG1L2z_2psc&pp=ygUdRGVmaW5lIEhlYXRpbmcgdmFsdWUgb2YgZnVlbC4%3D
49	Explain Calorific value and Quality of I C engine fuel.	VI	1	LM/ IM	CO6	T1 T2	T1 : T2 :	https://www.youtube.com/watch?v=-vnGuG8ztm4&pp=ygU3RXhwbGFpbibDYWxvcmlmaWMgdmFsdWUgYW5kIFF1YWxpdHkgb2YgSSBDIGVuZ2luZSBmdWVsLg%3D%3D
50	Discussion on Previous year question paper		1	LM/ IM				
51	Discussion on Previous year question paper		1	LM/ IM				
52	Discussion on Previous year question paper		1	LM/ IM				



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53	Discussion on Previous year question paper		1	LM/ IM				
54	Assignment Evaluation & Class Test.		1	LM/ IM				
55	Solve numerical on first law of thermodynamics		1	LM/ IM				
56	Solve numerical on second law of thermodynamics.		1	LM/ IM				
57	Solve numerical on I c engine and gas power cycle.		1	LM/ IM				
58	Surprise Test/Assignment.		1	LM/ IM				
59	Quiz Test/Assignment.		1	LM/ IM				
60	Previous year question paper discussion.		1	LM/ IM				

LM: Learner Mode: Chalk & Talk, Lecture

IM: Interactive Mode: PPT, VIDEO and Animation



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Learning resources:

- T1: P.K.Nag Engineering Thermodynamics TMH
- T2: R.S. Khurmi Thermal Engineering S.Chand
- T3: A.S. Sarao Thermal Engineering Satya Prakash
- T4: A.R.Basu Thermal Engineering Dhanpat Rai
- T5: Mahesh M Rathore Thermal Engineering TMH

R1:

R2:

Suggested link from NPTEL video/Suggested web reading:

Signature of the Faculty

Signature of the HOD