

FUNDAMENTALS OF MECHANICAL ENGINEERING

Subject Code: **ME514OE**

Regulations: **R16 - JNTUH**

Class : **III Year B.Tech CE I Semester**



Department of Civil Engineering

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Ibrahimpatnam - 501 510, Hyderabad

FUNDAMENTALS OF MECHANICAL ENGINEERING (ME514OE) COURSE PLANNER

I. COURSE OVERVIEW:

After learning the course the students should be able to

- To understand the fundamentals of mechanical systems.
- To understand and appreciate significance of mechanical engineering in different fields of engineering.

II. PREREQUISITE(S):

None

III. COURSE OBJECTIVES:

1.	To introduce the Mechanical Engineering discipline and its applications to society.
2.	Preparatory course presented in digital audio-visual, non-analytical form to inspire students to take up Mechanical Engineering as a career.
3.	To understand the first, second law of thermodynamics

IV. COURSE OUTCOMES:

.No	Description	Bloom's Taxonomy Level
1.	Understand the basic principles of thermodynamics like conservation of mass, conservation of energy and the second law of thermodynamics.	Understand (Level 2)
2.	Analyze the performance of various boilers and to identify method for improving thermodynamic performance.	Analyze (Level 4)
3.	Know about different fields of applications of Mechanical Engineering and its interrelationship with other fields of science and engineering.	Apply (Level 3)
4.	Understand the scope of engineering, especially Mechanical Engineering and its impact on society.	Understand (Level 2)
5.	Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	Analyze (Level 4)

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (PO)		Level	Proficiency assessed by
PO1	Engineering knowledge: Graduates will demonstrate the ability to use basic knowledge in mathematics, science and engineering and apply them to solve problems specific to mechanical engineering.	1	Assignments
PO2	Problem analysis: Graduates will demonstrate the ability to design and conduct experiments, interpret and analyze data, and report results.	1	---
PO3	Design/development of solutions: Graduates will demonstrate the ability to design any mechanical system or thermal that meets desired specifications and requirements.	2	---
PO4	Conduct investigations of complex problems: Graduates will demonstrate the ability to identify, formulate and solve mechanical	1	---

Program Outcomes (PO)		Level	Proficiency assessed by
	engineering problems of a complex kind.		
PO5	Modern tool usage: Graduates will be familiar with applying software methods and modern computer tools to analyze mechanical engineering problems.	1	---
PO6	The engineer and society: Apply reasoning informed by the contextual know ledge to assesssocietal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	2	Assignments
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	3	Assignments
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	3	---
PO9	Individual and team work: Graduates will demonstrate the ability to function as a coherent unit in multidisciplinary design teams, and deliver results through collaborative research.	2	---
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective report sand design documentation, make effective presentations, and give and receive clear instructions.	2	---
PO11	Project management and finance: Graduate will be able to design a system to meet desired needs within environmental, economic, political, ethical, health and safety, manufacturability and management knowledge and techniques to estimate time, resource to complete project.	2	---
PO12	Life-long learning: Graduates should be capable of self-education and clearly understand the value of life-long learning.	1	Research

**1: Slight
(Low)**

**2: Moderate
(Medium)**

**3: Substantial
(High)**

- : None

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSO)		Level	Proficiency assessed by
PSO1	Foundation of mathematical concepts: To use mathematical methodologies to crack problem using suitable mathematical analysis, data structure and suitable algorithm.	1	---

Program Specific Outcomes (PSO)		Level	Proficiency assessed by
PSO2	Foundation of Mechanical System: The ability to interpret the fundamental concepts and methodology of Mechanical systems. Students can understand the functionality of different machine, men and material.	2	Research
PSO3	Layout of plant: The ability to grasp the knowledge of plant layout and material handling along with the systematic allocation of all the facilities.	2	---

**1: Slight
(Low)**

**2: Moderate
(Medium)**

**3: Substantial
(High)**

VII. SYLLABUS:

JNTUH:

UNIT – I

Introduction: Prime movers and its types, Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Change of state, Path, Process, Cycle, Internal energy, Enthalpy, Statements of Zeroth Law and First law. Energy: Introduction and applications of Energy sources like Fossil fuels, Nuclear fuels, Hydel, Solar, wind, and bio-fuels, Environmental issues like Global warming and Ozone depletion.

UNIT – II

Properties of gases: Gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant, Relation between C_p and C_v , Various non-flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Poly-tropic process Properties of Steam: Steam formation, Types of Steam, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of Steam tables, steam calorimeters. Steam Boilers: Introduction, Classification, Cochran, Lancashire and Babcock and Wilcox boiler, functioning of different mountings and accessories.

UNIT – III

Heat Engines: Heat Engine cycle and Heat Engine, working substances, Classification of heat engines, Description and thermal efficiency of Carnot; Rankine; Otto cycle and Diesel cycles. Internal Combustion Engines: Introduction, Classification, Engine details, four-stroke/ two-stroke cycle Petrol/Diesel engines, Indicated power, Brake Power, Efficiencies.

UNIT – IV

Pumps: Types and operation of Reciprocating, Rotary and Centrifugal pumps, Priming Air Compressors: Types and operation of Reciprocating and Rotary air compressors, significance of Multistage. Refrigeration & Air Conditioning: Refrigerant, Vapor compression refrigeration system, vapor absorption refrigeration system, Domestic Refrigerator, Window and split air conditioners.

UNIT – V

Couplings, Clutches and Brakes: Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc). Transmission of Motion and Power: Shaft and axle, Belt drive, Chain drive, Friction drive, Gear drive. Engineering Materials: Types and applications of Ferrous & Nonferrous metals, Timber, Abrasive material, silica, ceramics, glass, graphite, diamond, plastic and polymer.

SUGGESTED BOOKS:

TEXT BOOKS:

1. Basic Mechanical Engineering / Pravin Kumar/ Pearson
2. Introduction to Engineering Materials / B.K. Agrawal/ McGraw Hill
3. Thermodynamics and Heat Engines / R. Yadav / Central Book Depot
4. Thermal Engineering-M.L.Marthur& Mehta/Jain bros
5. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.
6. Thermal Engineering-P.L.Bellaney/ Khanna publishers.
7. Elements of Environmental Science and Engineering-Meenakshi/Anjali Bagad.

REFERENCE BOOKS:

1. Fundamental of Mechanical Engineering/ G.S. Sawhney/PHI
2. Thermal Science and Engineering / Dr. D.S. Kumar/ Kataria

NPTEL WEB COURSE:

nptel.ac.in/downloads/112107219/

NPTEL VIDEO COURSE:

nptel.ac.in/downloads/112107219/#

GATE SYLLABUS:

NOT APPLICABLE

IES SYLLABUS:

NOT APPLICABLE

VIII. COURSE PLAN:

Lecture No.	Week No.	TOPIC	Reference
UNIT – 1			
1.	1	Introduction to Prime movers and its types	Text Book No. 1 Ref Book No.1,2,3,7
2.		Concept of Force, Pressure, Energy, Work, Power.	
3.		System, Heat, Temperature, Specific heat capacity	
4.		Change of state, Path, Process, Cycle,	
5.	2	Internal energy, Enthalpy	
6.		Statements of Zeroth Law and First law	
7.		Energy: Introduction and applications of Energy sources like Fossil fuels.	
8.		Nuclear fuels, Hydel, Solar, wind, and Bio-fuels.	
9.	3	Environmental issues like Global warming and Ozone depletion.	
10.		Revision	

11.		Revision	
12.		Mock Test – I	
UNIT – 2			
13.	4	Properties of gases	Text Book No. 1 Ref Book No.1,3,5,6
14.		Gas laws, Boyle’s law, Charle’s law	
15.		Combined gas law, Gas constant	
16.		Relation between Cp and Cv	
		Tutorial / Bridge Class # 1	
17.	5	Various non-flow processes like constant volume process	
18.		Constant pressure process, Isothermal process	
19.		Adiabatic process, Poly-tropic process	
20.		Properties of Steam: Steam formation, Types of Steam	
		Tutorial / Bridge Class # 2	
21.	6	Enthalpy, Specific volume, Internal energy and dryness fraction of steam	
22.		Use of Steam tables, Steam calorimeters	
23.		Steam Boilers: Introduction	
24.		Classification and functioning of boiler mountings and accessories.	
		Tutorial / Bridge Class # 3	
UNIT – 3			
25.	7	Introduction to Heat Engine cycle	Text Book No. 1 Ref Book No. 1,3,5,6
26.		Properties of Working substances	
27.		Classification of Heat Engines	
28.		Description and Thermal Efficiency of Carnot Cycle	
		Tutorial / Bridge Class # 4	
29.	8	Description and Thermal Efficiency of Rankine Cycle	
30.		Description and Thermal Efficiency of Otto Cycle	
31.		Description and Thermal Efficiency of Diesel Cycle	
32.		Description and Thermal Efficiency of Internal Combustion Engines.	
		Tutorial / Bridge Class # 5	
I Mid Examinations (Week 9)			
UNIT – 3 Contd.			
33.	10	Classification of Internal Combustion Engines.	
34.		Four- stroke/ Two-stroke cycle	
35.		Petrol/Diesel engines	
36.		Indicated power, Brake Power, Efficiencies	
		Tutorial / Bridge Class # 6	
UNIT – 4			
37.	11	Pumps and it’s Types	Text Book No. 1 Ref Book
38.		Operation of Reciprocating, Rotary and Centrifugal pumps	

39.		Priming Air Compressors and its Types.	No. 1, 2	
40.		Significance of Multistage.		
		Tutorial / Bridge Class # 7		
41.	12	Introduction to Refrigeration & Air Conditioning	Text Book No. 1, 2 Ref Book No. 1	
42.		Refrigerant, Vapor compression refrigeration system		
43.		Vapor absorption refrigeration system		
44.		Window and Split Air Conditioners.		
		Tutorial / Bridge Class # 8		
45.	13	Classification of Window and Split Air Conditioners.		
46.		Classification of Vapor Absorption Refrigeration Systems.		
47.		Revision		
48.		Revision		
		Mock Test – II		
UNIT – 5				
49.	14	Couplings, Clutches and Brakes.		Text Book No. 1, 2 Ref Book No. 1
50.		Construction and Applications of Couplings.		
51.		Construction and Applications of Clutches.		
52.		Construction and Applications of Brakes.		
		Tutorial / Bridge Class # 9		
53.	15	Transmission of Motion and Power.		
54.		Shaft and axle, Belt drive, Chain drive.		
55.		Friction drive, Gear drive.		
56.		Diversity factor and related exercises.		
		Tutorial / Bridge Class # 10		
57.	16	Engineering Materials and its Types		
58.		Applications of Ferrous & Nonferrous metals.		
59.		Timber, Abrasive material, silica, ceramics		
60.		Glass, Graphite, Diamond, Plastic and Polymer.		
		Tutorial / Bridge Class # 11		
61.	17	Revision		
62.		Revision		
63.		Revision		
			Tutorial / Bridge Class # 12	
II Mid Examinations (Week 18)				

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	2	-	-	-	-	-	-	1	-
CO2	1	2	-	-	-	1	-	-	-	-	-	-	-	1	-
CO3	2	-	-	-	-	-	1	-	-	-	-	1	-	1	-
CO4	1	-	-	-	-	-	1	-	-	-	-	-	-	1	-
CO5	2	2	3	-	-	-	1	-	-	-	-	1	2	1	-
AVG	2.25	0.8	0.6	-	-	0.6	1	-	-	-	-	0.4	0.4	1	-

X. QUESTION BANK: (JNTUH)

DESCRIPTIVE QUESTIONS: (WITH BLOOMS PHRASES)

UNIT-I

SHORT ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcomes
1.	Define prime mover	Remember	3
2.	What are the types of prime movers?	Remember	3
3.	Define Force, Pressure, Energy, Work and Power?	Remember	3
4.	Define State, Process, Path and Cycle?	Remember	1
5.	Define Internal Energy and Enthalpy?	Remember	1
6.	Explain the statements of Zeroth and First law of Thermodynamics?	Understand	1
7.	Define Biofuel?	Remember	3

LONG ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcomes
1.	Differentiate the terms system, surroundings and boundary. Explain them in detail?	Analyze	2
2.	State Zeroth law and explain with a good example?	Remember	1
3.	Compare the first law of thermodynamics with its corollaries?	Evaluate	1
4.	Explain the Joule's experiment with a neat sketch?	Understand	1
5.	Explain the limitations of First law of thermodynamics in detail?	Understand	1
6.	Compare the relation with process and cycle?	Evaluate	1
7.	What is a prime mover and what are its types?	Remember	3
8.	Explain about global warming and ozone depletion?	Understand	4
9.	Define Fuel and explain various types and applications of fuels?	Remember	4
10.	Describe some few words about Fossil, Nuclear, Solar and Hydel Fuels?	Remember	4

UNIT-II**SHORT ANSWER QUESTIONS:**

S. No	Question	Blooms Taxonomy Level	Course Outcomes
1.	Define Gases and its properties?	Remember	1
2.	What are the types of gas laws?	Remember	1
3.	Define Specific Heat of gases?	Remember	1
4.	Define Gas constant and Universal gas constant?	Remember	1
5.	Determine the relation between c_p and c_v of gases?	Evaluate	1
6.	What is Dryness Fraction of steam?	Remember	1
7.	What is adiabatic process and polytropic process?	Remember	1
8.	Define Steam Boiler?	Remember	1
9.	Define Specific Volume?	Remember	1
10.	What is steam calorimeter?	Remember	1

LONG ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcomes
1.	Explain the Mole fraction and Mass fraction in the Mixture of Perfect gas?	Understand	1
2.	Enumerate the Perfect Gas Laws and analyze from thermodynamics point of view?	Create	1
3.	Define dryness fraction? What are the different methods	Remember	1

	of measurement of dryness fraction?		
4.	Derive the relation between C_p , C_v and R of a gas?	Create	1
5.	Derive the expression for work done in i) Isothermal process ii) Polytropic process?	Create	1
6.	Derive the expression for work done in i) Isobaric process ii) Isochoric process and iii) Adiabatic process?	Create	1
7.	Enumerate the Isobaric process from thermodynamic point of view?	Create	1
8.	Enumerate the Isochoric process from thermodynamic point of view?	Create	1
9.	Enumerate the Isothermal process from thermodynamic point of view?	Create	1
10.	Enumerate the Adiabatic process from thermodynamic point of view?	Create	1
11.	Enumerate the Polytropic process from thermodynamic point of view?	Create	1

UNIT-III

SHORT ANSWER QUESTIONS

S. No	Question	Blooms Taxonomy Level	Course Outcomes
1.	Define Heat Engine?	Remember	1
2.	What is a working substance and its properties?	Remember	1
3.	What are the processes of Carnot cycle, Otto cycle, Diesel and Rankine Cycle?	Remember	1
4.	Define I.C Engine?	Remember	2
5.	Difference between I.C and E.C Engines?	Analyze	2
6.	Define and differentiate the processes taking place in two stroke and four stroke engines?	Remember	2
7.	Define Indicated and Brake Power and its efficiencies?	Remember	2
8.	What are the classifications of I.C Engines?	Remember	2
9.	Define Cycle?	Remember	1

LONG ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcomes
1.	List the Processes in Otto cycle and represent on P-V and T-S diagrams?	Remember	1,2
2.	Explain the working principle of Otto cycle with a diagram.	Understand	1,2
3.	Derive thermal efficiency of Otto cycle?	Create	1,2
4.	Derive thermal efficiency of Diesel cycle?	Create	1,2
5.	Explain the working principle of Diesel cycle with a diagram?	Understand	1,2
6.	Explain the heat engine with a neat sketch?	Understand	1,2

7.	State the Carnot's principle? What is the importance of the principle, explain?	Remember	1,2
8.	What are various types of SI engine cylinder designs, write in detail about them. (type, L type, I type, F type)	Remember	1,2
9.	With all minute details, explain the factors affecting the knocking including the fuel characteristics for S I Engines and C I Engines.	Apply	1,2
10.	Bring out differences in two stroke and four stroke engines, explain the same with aid of diagrams.	Analyze	1,2
11.	Differentiate S.I. and C.I. engines.	Analyze	1,2

UNIT-IV

SHORT ANSWER QUESTIONS

S.No	Question	Blooms Taxonomy Level	Course Outcomes
1.	Define pumps and its types?	Remember	3
2.	Define Air Compressor and its priming?	Remember	1
3.	Define Refrigeration and Air Conditioning and their basic difference?	Remember	1,2
4.	What is a Refrigerant?	Remember	1
5.	Define the processes in vapour compression and vapour absorption refrigeration systems?	Remember	1,2
6.	What are Window and Split Air Conditioners and its types?	Remember	1,2

LONG ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcomes
1.	Explain the various properties of psychrometry ?	Understand	1
2.	Explain the working principle of vapor compression cycle?	Understand	1
3.	Derive the COP of vapor compression cycle?	Create	1
4.	Explain the working principle of vapor absorption cycle?	Understand	1
5.	Derive the COP of vapor absorption cycle?	Create	1
6.	Explain the working principle of Domestic Refrigerator?	Understand	1
7.	Explain the working of window and split air conditioner	Understand	1
8.	What is the condition for maximum efficiency in multistage compression?	Remember	1
9.	Define and Classify of compressors?	Remember	1
10.	Explain the working principle and operation of reciprocating compressor with the help of a neat diagram?	Understand	1
11.	Explain the working principle and operation of rotary compressor with the help of a neat diagram?	Understand	1
12.	Explain the working principle and operation of	Understand	3

	reciprocating pump with the help of a neat diagram?		
13.	Explain the working principle and operation of rotary pump with the help of a neat diagram?	Understand	3
14.	Explain the working principle and operation of centrifugal pump with the help of a neat diagram?	Understand	3

UNIT-V

SHORT ANSWER QUESTIONS

S.No	Question	Blooms Taxonomy Level	Course Outcomes
1.	Define Coupling, Clutches and Brakes?	Remember	3
2.	Define Gear?	Remember	3
3.	Define Polymer and its types?	Remember	4
4.	What are the applications of ferrous and non-ferrous materials?	Remember	3,4
5.	What is an Abrasive?	Remember	4
6.	What is a Diversity Factor?	Remember	4
7.	Define Ductile and Brittle materials?	Remember	3,4

LONG ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcomes
1.	Describe the construction, applications and types of Couplings?	Remember	5
2.	Describe the construction, applications and types of Clutches?	Remember	5
3.	Describe the construction, applications and types of Brakes?	Remember	5
4.	Derive the condition for transmission of maximum power in belt drives.	Create	4
5.	What are cast irons? Define white cast iron and explain its uses?	Remember	4
6.	What is nodular cast iron? Explain its uses ?What factors control the structure of cast iron?	Remember	4
7.	Explain importance of copper for engineering applications? Discuss various types of brasses and their applications.	Understand	4
8.	Discuss tin bronzes and important applications? What is alclad and explain its advantages?	Understand	4
9.	What are glass ceramics? Explain applications of various types of glasses?	Remember	4
10.	Discuss classification of polymers? Write briefly about thermo plastics and thermosetting plastics?	Understand	4
11.	Explain manufacture of Fibre reinforced plastic? Bring out the typical applications of FRP?	Understand	4

XI. OBJECTIVE QUESTIONS: JNTUH

UNIT-I

1. A definite area or space where some thermodynamic process take place is known as_____.
2. When neither mass nor energy is allowed to cross the boundary of a system is called_____.
3. Atmospheric pressure is equal to_____ mm of Hg.
4. First Law of thermodynamics deal with _____.
5. When a processes are performed on a system in such a way that the final state is identical with the initial state is called_____.
6. Work is defined as the product of _____.
7. Units of heat are _____.
8. Temperature is defined as the degree of _____ of a body.
9. Temperature of human body is generally measured by using a device called as _____
10. Two commonly used scales for measuring the temperature of a body are _____.
11. $1^{\circ}\text{C} = \text{_____ F}$.
12. When a system changes its state from one equilibrium state to another then the path of successive states through the system passes is called _____.

UNIT-II

1. The sum of partial volumes of all gases in a mixture is equal to_____.
2. The volume occupied by one number of unit mol of gas is called as_____.
3. An Adiabatic process is one in which _____ is zero.
4. An Isothermal process is one in which _____ is zero.
5. $C_p - C_v = \text{_____}$.
6. The ratio of specific heat at constant pressure (c_p) and specific heat at constant volume (c_v) is _____.
7. If the value of $n = 0$ in the equation $pV^n = C$, then the process is called_____.
8. The value of specific heat at constant pressure (c_p) is _____ that of at constant volume (c_v).
9. The value of gas constant (R) in S.I. units is _____.
10. The absolute zero temperature is taken as _____ $^{\circ}\text{C}$.

UNIT-III

1. A cycle consisting of one constant pressure, one constant volume and two isentropic processes is known as _____.
2. The compression ratio for petrol engines is _____.
3. The efficiency of Diesel cycle approaches to Otto cycle efficiency when cutoff is _____
4. The efficiency of Diesel cycle increases with _____ in cutoff.
5. During which of the following process does heat rejection takes place in Carnot cycle?
6. The compression ratio for Diesel engines is _____.
7. Otto cycle efficiency is higher than Diesel cycle efficiency for the same compression ratio and heat input because in Otto cycle heat rejection is higher/lower.
8. Otto cycle is also known as constant _____ cycle.
9. The efficiency of Diesel cycle depends upon _____ and _____.
10. The efficiency of Carnot cycle depends upon _____.

UNIT-IV

1. Slip of a reciprocating pump is defined as the _____.
2. Multi-stage centrifugal pumps are used to _____.
3. The discharge of a double acting reciprocating pump is (where L = Length of stroke, A = Cross-sectional area of piston, and N = Speed of crank in r.p.m.) _____
4. Discharge (Q) of a centrifugal pump is given by (where D = Diameter of impeller at inlet, b = Width of impeller at inlet, and V_f = Velocity of flow at inlet) _____
5. A centrifugal pump will start delivering liquid only when the pressure rise in the impeller is equal to the _____.
6. For centrifugal pump impeller, the maximum value of the vane exit angle is _____
7. The ratio of quantity of liquid discharged per second from the pump to the quantity of liquid passing per second through the impeller is known as _____.
8. The impeller of a centrifugal pump may have _____.
9. Power required (in watts) to drive a centrifugal pump is (where H_m = Manometric head in metres, w = Specific weight in N/m^3 , Q = Discharge of the pump in m^3/s , and η_o = Overall efficiency of the pump) _____.
10. Overall efficiency of a centrifugal pump is the ratio of _____.

UNIT-V

1. The railway carriage couplings have _____ threads.
2. A steel containing upto 0.15% carbon is known as _____.
3. The sleeve or muff coupling is designed as a _____.
4. In a flange coupling, the flanges are coupled together by means of _____.
5. An universal coupling is used to connect two shafts whose axis intersect at _____ angle.
6. _____ is a positive drive.
7. In a marine flange coupling, the thickness of flange is taken as _____.
8. The property of a material which enables it to be drawn into wires with the application of a tensile force, is called _____.
9. The ratio of driving tensions in V-belt drives is _____ flat belt drives.
10. A steel containing _____ 0.8% carbon is known as hypo-eutectoid steel.

XII. GATE QUESTIONS:

NA

XIII. WEBSITES:

1. www.iitd.ac.in
2. www.nptel.ac.in
3. www.mit.edu

XIV. EXPERT DETAILS:

1. Dr.Pravin Kumar
2. K. Agrawal/ McGraw Hill
3. Meenakshi/Anjali Bagad.

XV. JOURNALS:

1. ASME Journal of Energy Resource Technology
2. ASME Journal of Engineering for Industry
3. ASME Journal of Solar Energy Engineering
4. Australian Journal of Mechanical Engineering

XVI. LIST OF TOPICS FOR STUDENT SEMINARS:

1. Steam boilers.
2. Pumps.
3. Heat Engines.
4. Engineering materials.
5. I.C Engines.

XVII. CASE STUDIES / SMALL PROJECTS:

1. Boilers-models.