

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- 1st / 2nd EXAMINATION (New Syllabus) – WINTER 2013

Subject Code: 2110006

Date: 21/12/2013

Subject Name: Elements of Mechanical Engineering

Time: 10:30 am to 1:00 pm

Total Marks: 70

Instructions:

1. Question No. 1 is compulsory. Attempt any four out of remaining Six questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Objective Questions:

07

1. Pump is a
(a) power producing machine (b) power consuming machine (c) universal machine
(d) all of above
2. Spark plug is used in
(a) petrol engine (b) diesel engine (c) steam engine (d) boiler
3. Cochran boiler is
(a) fire tube (b) water tube (c) single tube (d) none of these
4. Wind velocity is measured by
(a) manometer (b) tachometer (c) anemometer (d) thermometer
5. If load on the bearing acts perpendicular to the axis of the shaft then bearing is known as
(a) journal bearing (b) thrust bearing (c) bushed bearing (d) radial bearing
6. When rotary motion is to be converted into linear motion following gear arrangement is used
(a) spur gear (b) spiral gear (c) rack and pinion gear (d) none of these
7. Which power transmission element is used in motor cycle?
(a) rope (b) flat belt (c) chain (d) V belt

(b) Objective Questions:

07

1. The first law of thermodynamic is the law of
(a) energy conservation (b) heat transfer (c) work transfer (d) all of these
2. Gauge pressure is measured with respect to
(a) absolute zero pressure (b) atmospheric pressure (c) vacuum pressure (d) all of these
3. The phase change from solid to vapour is called
(a) sublimation (b) vaporization (c) pressurization (d) temperature
4. Which coal is having the highest calorific value?
(a) bituminous coal (b) lignite coal (c) anthracite coal (d) coke
5. Internal energy of a gas is a function of
(a) enthalpy (b) pressure (c) pressure and volume (d) temperature
6. Following is not a component of Rankine Cycle
(a) boiler (b) turbine (c) condenser (d) compressor
7. In a domestic vapour compression refrigerator the refrigerant commonly used is
(a) ammonia (b) air (c) CO₂ (d) Freon-12

- Q.2** (a) What is an adiabatic process? For adiabatic process with the usual notation prove $PV^\gamma = \text{constant}$. **07**
- (b) Determine enthalpy and internal energy of 1 kg of steam at a pressure of 12 bar when (i) the dryness fraction of steam is 0.8 (ii) steam is dry and saturated (iii) steam is superheated to 280°C . Take $C_{ps} = 2.1 \text{ kJ/kg K}$. **07**
- Q.3** (a) Give detailed classification of fuel. Write short note on wind energy. **07**
- (b) An air at 15°C and 1 bar is compressed adiabatically to 15 bar by an engine working on Otto cycle. The maximum pressure of the cycle is 40 bar. Calculate air standard efficiency, mean effective pressure. Take $C_v = 0.718 \text{ kJ/kg K}$ and $R = 0.287 \text{ kJ/kg K}$. **07**
- Q.4** (a) Differentiate between fire tube and water tube boiler. Explain Babcock and Wilcox boiler construction with neat sketch. **07**
- (b) Explain economiser and air-preheater with neat sketch. **07**
- Q.5** (a) What is throttling process? Explain throttling calorimeter with neat sketch. Derive equation for dryness fraction. **07**
- (b) During testing of single cylinder two stroke petrol engine following data were obtained. Brake torque 640Nm, cylinder diameter 21cm, speed 350 rpm, stroke length 28 cm, mean effective pressure 5.6 bar, oil consumption 8.16 kg/hr, CV 42705 kJ/kg. Determine (i) mechanical efficiency (ii) Indicated thermal efficiency (iii) Brake thermal efficiency (iv) brake specific fuel consumption. **07**
- Q.6** (a) What is compressor? Explain working of double acting reciprocating pump and bucket pump with neat sketch. **07**
- (b) What is refrigeration? What is refrigeration effect? Explain window air conditioner with neat sketch. **07**
- Q.7** (a) What is brake? Describe an internal expanding shoe brake with a neat sketch and state its applications. **07**
- (b) (1) Sketch and describe helical and bevel gear and state applications of each. **04**
- (2) Define elasticity, rigidity, hardness, fatigue, ductility, brittleness. **03**
