

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-1st / 2nd (NEW) EXAMINATION – WINTER 2015

Subject Code: 2110006

Date: 23/12/2015

Subject Name: Elements of Mechanical Engineering

Time: 10:30am to 01:00pm

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.
4. Steam tables are permitted.

Q.1 Objective Question (MCQ)

(a) 07

1. Prime mover is a device which converts natural resources into _____ energy.
(a) With decrease in pressure (b) with increase in pressure
(c) is unaffected by pressure (d) none of the above
2. Zeroth law of thermodynamics forms the basis of measurement of the following.
(a) heat exchange (b) work (c) pressure (d) Temperature
3. Polytropic expansion of a gas is given by the law
(a) $pV^n = C$ (b) $pV^r = C$ (c) $pV = C$ (d) $pV^0 = C$
4. Behaviour of vapour can be determined by
(a) Boyles law (b) Charles law (c) Combined law (d) none of the above
5. Bucket pump is a type of _____ pump.
(a) rotary (b) Centrifugal (c) reciprocating (d) axial
6. Centrifugal compressor is suitable for producing?
(a) High pressure (b) medium pressure (c) low pressure (d) all of the above
7. Spur gear has teeth _____ to the axes of the gears.
(a) inclined (b) parallel (c) perpendicular (d) any of the above

(b) 07

1. The energy absorbed by brakes is released in surrounding in form of
(a) heat energy (b) kinetic energy (c) potential energy (d) pressure energy
2. Which engine produces more power for same compression ratio
(a) 4- stroke diesel engine (b) 4- stroke petrol engine
(c) 2- stroke diesel engine (d) 2- stroke petrol engine
3. The operation of filling passage ways with liquid from outside source before starting pumps is known as _____.
(a) cavitation (b) cleaning (c) priming (d) chocking
4. One ton of refrigeration is equal to
(a) 221 kJ/min (b) 420 kJ/min (c) 600 kJ/min (d) 210 kJ/min
5. Belt drive provides _____ flexibility compared to gear drive.
(a) more (b) less (c) same (d) can't say
6. Which of the following elements is used to connect two shafts _____.
(a) clutch (b) brakes (c) Couplings (d) none of above
7. _____ is the characteristic of cast iron.
(a) ductile (b) malleable (c) very brittle (d) all of the above

Q.2 (a) Write a short note on Global Warming. 03

(b) Define isothermal process. Derive the expression for work done, change in internal energy and heat transfer for this process. 04

(c) One cubic meter of air at pressure of 1.5 bar and 80°C is compressed to final pressure 8 bar and volume 0.28 m³. Determine (i) mass of air (ii) 07

index of 'n' compression (iii) change in internal energy (iv) Heat transfer during compression. Take $\gamma = 1.4$ and $R = 287 \text{ J/kgK}$.

- Q.3** (a) Show the function and location of the following in the boiler plant: **03**
(i) Feed check valve (ii) Air superheater (iii) Fusible plug.
- (b) Explain Throttling calorimeter with neat sketch and calculation of dryness fraction. **04**
- (c) Sketch and explain a Babcock and Wilcox boiler. **07**
- Q.4** (a) Differentiate between Two stroke and Four stroke I.C engines. **03**
- (b) Determine the quality of steam for the following cases: **04**
(i) $P = 10 \text{ bar}$, $v = 0.180 \text{ m}^3/\text{kg}$
(ii) $P = 10 \text{ bar}$, $t = 200^\circ\text{C}$
(iii) $P = 25 \text{ bar}$, $h = 2750 \text{ kJ/kg}$
- (c) Derive equation for air standard efficiency of Diesel cycle. **07**
- Q.5** (a) Explain the working principle of centrifugal pump with neat sketch? **03**
- (b) The following data refers to a single cylinder 4 strokes petrol engine. **04**
Cylinder diameter = 30 cm, piston stroke = 40 cm, engine speed = 1400 r.p.m, indicated mean effective pressure = 5 bar, fuel consumption = 17.568 kg per hour, calorific value of the fuel is 45000 kJ/Kg; specific gravity of the fuel is 0.8. Determine the indicated thermal efficiency.
- (c) Explain Vapor Compression Refrigeration system with neat sketch. Also draw p-h and T-s diagram for the same. **07**
- Q.6** (a) Define air-conditioning. Classify the air conditioning system in detail. **03**
- (b) Why multi-stage compression is required? Write advantages of the multi-staging compression. **04**
- (c) What are the different types of couplings? Explain the centrifugal clutch. **07**
- Q.7** (a) Define the following mechanical properties **03**
(i) Elasticity (ii) Toughness (iii) Ductility
- (b) Explain the working principle of vane pump with neat sketch? **04**
- (c) What are bearings? Explain with neat sketch worm and worm wheel. **07**
