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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belgaum)

First Semester B.E. (Credit System) Degree Examinations

Make up Examinations - January 2015

14ME104 – ELEMENTS OF MECHANICAL ENGINEERING

Duration: 3 Hours | Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

Unit – I

1. a) List the advantages and disadvantages of renewable and nonrenewable energy sources. 6
   b) With the help of a block diagram explain closed loop control system. 5
   c) Neatly draw and label the parts of a cochron boiler explain its working principle. 9

2. a) Define i) Saturation temperature, ii) Sensible heat iii) Specific volume of wet steam iv) Enthalpy of superheated steam. 6
   b) One kg of superheated steam at 1.5 MPa contains 4000 kJ of heat energy. Find the super heated temperature. Assume Cps=2.25 kJ/kgK What is the final quality of the steam after each of the following operations
      i) If 500 kJ of heat is removed at constant pressure
      ii) If 500kJ of heat is added at constant pressure
      From steam tables at 15 bar T_s=198.29°C, h_f=844.6kJ/kg, h_{fg}=2789.9kJ/kg. 6
   c) Differentiate between boiler mounting and accessories.
      Mention the uses of i) Feed check valve ii) Super heater iii) Safety valves 8

Unit – II

3. a) Explain the Different parts of an I.C. Engine with the help of a diagram. 10
   b) Differentiate between Impulse and Reaction water Turbine 5
   c) A four cylinder, four stroke internal combustion engine develops an indicated power of 50 kW at 3000 rpm. The cylinder diameter is 75mm. and the stroke is 90 mm. Find the mean effective pressure in each cylinder. If the mechanical efficiency is 80 %, what effective brake load would be required if the effective brake drum diameter is 0.6 m. 5

4. a) List any five differences of Four stroke and two stroke engines. 5
   b) Explain Pressure Compounding with sketch. 5
   c) With a neat sketch explain closed cycle gas turbine 5
   d) Explain Pelton turbine with a neat sketch. 5

Unit – III

5. a) Sketch and explain wick lubricator. 5
   b) What are the desirable properties of a Good Refrigerant 7
   c) Sketch and explain the main components of a refrigerator. 8

6. a) Sketch and explain the Air-Conditioning system. 10
   b) Describe with sketch working of bushed bearing 5
   c) With a neat sketch explain working principle of single stage air compressor 5

Unit – IV

7. a) With a neat sketch of engine lathe illustrate its parts. 10
   b) What is a drilling machine and demonstrate radial drilling machine with a neat sketch. 10

8. a) Give the classification of milling machine and present horizontal milling machine with sketch. 10

P.T.O.

c) Explain the working principle of single stage air compressor with the help of sketch.

Unit – IV

7. a) Explain with sketch the taper turning by swiveling compound rest method in Lathe.
   b) Differentiate between Up milling and Down milling with sketch.
   c) Explain the different types of bonding methods.

8. a) With neat sketch explain the working of Horizontal Milling Machine.
   b) With neat sketches write short notes on the following.
      i) Boring.
      ii) Counter sinking.
   c) With a neat sketch explain sensitive drilling machine.

Unit – V

a) Deduce an expression for the ratio of tensions in a flat belt drive.
b) Present the differences between brazing and welding?
c) A simple gear train is made up of 4 gears A, B, C and D having 20, 40, 60, 70 teeth respectively. If gear A is the main driver rotating at 500 rpm CW, calculate the speeds of the intermediate gears and the speed and direction of the last follower.

a) In a belt drive, the ratio of tensions is 2, slack side tension = 50 kg. If the speed and diameter of the driven pulley are 200 rpm and 120 cm respectively, find the power transmitted and the initial tension in the belt.
b) Enumerate the applications, advantages and disadvantages of gear drives.
c) What are the merits of Soldering?

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

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Second Semester B.E. (Credit System) Degree Examinations

April - May 2015

14ME104 – ELEMENTS OF MECHANICAL ENGINEERING

Time: 3 Hours Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

Unit – I

a) What is the amount of heat supplied in the superheater, if 5 kg of wet steam of dryness 0.8 is passed from a boiler to a superheater at a constant pressure of 1 MPa, the temperature in the superheater being increased to 350°C. Take C_p = 2.25 kJ/kgK and properties of steam at 1 MPa are : T_s =179.88°C, h_f=762.61 kJ/kg, h_{fg}=2013.6 kJ/kg. 06

b) What is meant by a closed loop control system? Enumerate its advantages. 06

c) Give an outline and label all the parts of a Babcock and Wilcox boiler, indicating the path of flue gases and water circulation. Illustrate its working in brief. 08

a) Why (i) Safety valves (ii) Feed check valves and (iii) Economizers are used in boilers? 06

b) Critically comment on the merits and demerits of geothermal energy. 08

c) 1 kg of steam at 1.5 MPa contains 3000 kJ of heat. What is the condition of steam? If 500 kJ of heat is removed at the same pressure, the steam would attain which state? Also, if 200 kJ is added at the same pressure, what will be the state of steam? Take C_p = 2.25 kJ/kgK and properties at 1.5 MPa are T_s =198.29°C, h_f=844.6 kJ/kg, h_{fg}=1945.2 kJ/kg 06

Unit – II

a) How are water turbines classified? Explain the working of Kaplan turbine with a neat sketch. 08

b) Mention the classifications of IC engines. 02

c) The following are the details of a 4 stroke petrol engine. Diameter of brake drum=60.03cm, full brake load on drum= 250N, Brake drum speed= 450 RPM, Calorific value of petrol= 40MJ/kg, Brake thermal efficiency= 32%, Mechanical Efficiency = 80%, Specific gravity of petrol=0.82. Determine
   i) Brake power
   ii) Indicated power
   iii) Fuel consumption in liters/second
   iv) Indicated thermal efficiency 10

a) With a neat sketch explain the working of four stroke CI engine. 08

b) Differentiate between impulse and reaction water turbine 04

c) A person conducted a test on a single cylinder 2 stroke petrol engine and found that the mechanical and brake thermal efficiencies of the engines were 0.7 and 0.2 respectively. The engine with a mean effective pressure of 6 bar ran at 300 rev/min, consuming fuel at the rate of 2.2 kg/h. Given that the stroke to bore ratio of the engine cylinder is 1.2. Find the bore and stroke of the engine in cm 08

Unit – III

a) Give the working principle of domestic refrigerator with circuit diagram. 08

b) What are the desirable properties of a good refrigerant? 06

c) Write a note on the lubrication system used in IC engines with suitable sketch. 06

a) Illustrate Thrust Ball Bearing with sketch. 07

b) With a neat sketch explain Plummer block. 08

P.T.O.

Unit – IV

7. a) With neat sketch explain the working of any two Milling operations.
   b) Draw the neat diagram of an engine lathe and label its parts
   c) Write a note on the following.
      i. Plain Turning
      ii. Facing

8. a) Draw a neat sketch of the radial drilling machine and explain its working.
   b) With simple sketch explain the principle of operation of
      (i) Surface grinding and (ii) Cylindrical grinding
   c) Differentiate between Up milling and Down milling with sketch.

Unit – V

9. a) Deduce an expression for the length of the belt in case of crossed arrangement.
   b) Enumerate the differences between soldering and brazing.
   c) Two spur gears P and Q connect two parallel shafts 450 mm apart. Gear P runs at double the speed of Q, which runs at 150 rpm CCW. If circular pitch = 20 mm, determine the number of teeth on the gears.

10. a) Two pulleys of diameters 300 mm and 750 mm mounted on two parallel shafts 1.5 m apart are connected by a leather belt 150 mm wide. If the maximum safe tension of the belt is 14 N/mm width, determine the maximum power transmitted for (i) open belt and (ii) crossed belt drive. Take belt speed = 540 m/min, coefficient of friction between belt and pulley rim = 0.25.
    b) Arrive at an expression for the train value of a compound gear train, choosing 4 gears A, B, C, D such that the gears B-C are compounded. Assume A drives B and C drives D.
    c) Outline the merits and demerits of welding.

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

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Second Semester B.E. (Credit System) Degree Examinations

Supplementary Examinations - July 2015

14ME104 – ELEMENTS OF MECHANICAL ENGINEERING

Duration: 3 Hours Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

Unit – I

1. a) With reference to the results obtained from steam generation experiment, what do you mean by (i) Dryness fraction (ii) Sensible heat (iii) Enthalpy of dry saturated steam? 06
   b) Give a comparison between renewable and non-renewable energy sources. 06
   c) A steam will be at 9 bar initially with dryness 0.98. What is the final quality and temperature of the steam when, at constant pressure it (i) loses 50 kJ/kg and (ii) receives 150 kJ/kg. Properties of steam at 9 bar are : T_s =448.33 K, h_f=742.5 kJ/kg, h_{fg}=2029.7 kJ/kg, C_p = 2.25 kJ/kgK. 08

2. a) Outline the working of a Cochran boiler with a neat labeled sketch. 08
   b) Enumerate the distinguishing features of an open loop and a closed loop control system. 06
   c) 0.2 kg of steam with an initial dryness fraction of 0.7 is heated at constant pressure of 7 bar till its temperature rises to 250°C. Calculate the enthalpy required taking the properties at 7 bar as T_s =165°C, h_f=697.1 kJ/kg, h_{fg}=2064.9 kJ/kg, C_p = 2.25 kJ/kgK. 06

Unit – II

3. a) With a neat sketch explain the working of a two stroke petrol engine. 06
   b) Differentiate between four stroke SI and four stroke CI engine 04
   c) A 4-cylinder 2 stroke petrol engine develops 30KW at 2500RPM. The mean effective pressure on each piston is 8 bar and mechanical efficiency is 80%. Calculate the diameter and stroke of each cylinder, stroke to bore ratio is 1:5. Also calculate the fuel consumption if brake thermal efficiency is 28%. The calorific value of the fuel is 43900kJ/kg 10

4. a) Sketch and explain the working of closed cycle gas turbine. Illustrate the differences between an open cycle and closed cycle gas turbine? 08
   b) Differentiate between two stroke and four stroke petrol engine. 02
   c) A single cylinder 4-Stroke IC engine has a swept volume of 6 litres and runs at the rated speed of 300 RPM. At full load, the torque developed was measured with a break drum dynamometer whose pulley diameter is 1m. The tension in the tight side and slack side of the belt is 700N and 300N respectively. 4kg of fuel was consumed in one hour the indicated mean effective pressure is 6 bar and the calorific value of the fuel is 42 MJ/kg. Calculate the brake power, Indicated Power, Mechanical Efficiency, Indicated thermal efficiency, Brake thermal Efficiency. 10

Unit – III

5. a) Give an overview of the working of Air-Conditioning system with a neat sketch. 10
   b) How syphon wick lubricator works? Explain with sketch. 05
   c) Describe with sketch working of bushed bearing. 05

6. a) With respect to the lubricants, explain its functions. What are the properties of a good lubricant? 08
   b) Explain the working principle of a Reciprocating pump with the help of neat sketch. 06
   c) Differentiate betweenVapour Compression and Absorption Refrigeration Systems. 06

P.T.O.

Unit – III

5. a) With a neat sketch explain taper turning by swiveling compound tool rest.
   b) Compare and contrast up milling and down milling
   c) With neat sketches explain the processes of counter boring and countersinking

6. a) Use neat sketches and Distinguish between principles of surface and cylindrical grinding processes.
   b) With the help of a neat sketch explain cylindrical configuration robot.
   c) Describe the advantages and applications of NC machines.

Unit – IV

7. a) Explain the basic concepts of refrigeration.
   b) Draw a neat sketch of a room air-conditioner and explain its working principle.
   c) Explain minimum of eight properties of a good refrigerant.

8. a) Explain with a neat sketch the working of vapour compression refrigerator.
   b) Explain the working of centrifugal pump with a neat sketch.

Unit – V

9. a) Sketch and explain the constructional features of a ball bearing.
   b) Enumerate the differences between welding and brazing.
   c) The driven pulley of 400mm diameter of a belt drive runs at 200rpm. The angle of lap is 165° and the coefficient of friction between the belt material and the pulley is 0.25. Find the power transmitted if the initial tension is not to exceed 10kN.

10. a) Explain the different types of lubricants with an example for each type.
    b) Differentiate between (i). Solder and spelter (ii). Soft solder and hard solder
    c) A simple gear train is made up of four gears A, B, C and D having 20, 40, 60 and 70 teeth respectively. If gear A is the main driver rotating at 500rpm clockwise, calculate the following:
       (i) Speeds of intermediate gears
       (ii) Speed and direction of the last follower
       (iii) Velocity ratio.
       Show the gear train arrangement schematically.

BT* Bloom's Taxonomy, L* Level

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First Semester B.E. (Credit System) Degree Examinations

November - December 2015

15ME104 – ELEMENTS OF MECHANICAL ENGINEERING

Duration: 3 Hours | Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

		Marks	BT*
	Unit – I		
1.	a) Steam initially will be at 9 bar and 0.98 dry. Find the final quality of the steam after each of the following operations • When steam looses 60 kJ at constant pressure. • When steam receives 125 kJ at constant pressure. At 9 bar T_s= 175.4°C, h_f=742.6 kJ/kg, h_{fg}=2029.5 kJ/kg , Cps=2.25kJ/kgK.	6	L*3
	b) With a neat sketch explain the working of a Cochron boiler	8	L1
	c) With a neat sketch explain the working principle of reaction steam turbine. Indicate the pressure – velocity changes	6	L2
2.	a) A mixture of saturated water and saturated steam at a temperature of 250°C is contained in a closed vessel of 0.1 m^3 capacity. If the mass of the saturated water is 2 kg, find the mass of steam in the vessel. Also find the specific volume dryness fraction and enthalpy of the mixture. At T_s =250°C v_f=0.0012513 m^3/kg v_g=0.05004 m^3/kg h_f=1085.8 kJ/kg h_{fg}= 1714.6 kJ/kg	9	L3
	b) What are boiler mountings? List the boiler mountings.	5	L1
	c) Differentiate water tube and fire tube boilers	6	L4
	Unit – II		
3.	a) With a neat sketch explain Open cycle gas turbine working principle.	5	L2
	b) Explain with suitable sketches the working principle of Otto cycle and also draw PV diagram for the same	10	L2
	c) Explain any five difference between 4 stroke and 2 stroke IC Engine	5	L2
4.	a) A 4 cylinder two-stroke cycle petrol engine develops a brake power of 30 kW at 2500 rpm. The mean effective pressure on each piston is 8 bar and mechanical efficiency is 80%. Calculate the diameter and stroke of each cylinder of stroke to bore ratio 1.5. Also calculate the fuel consumption of the engine, if brake thermal efficiency is 28%. The calorific value of the fuel is 43,900 kJ/kg	8	L3
	b) Explain Pelton wheel with the help of a neat sketch	8	L2
	c) Differentiate between closed and open cycle gas turbine	4	L4

P.T.O.

6. a) Briefly explain the processes of end milling and slot milling.
   b) Describe the application and advantages of robots
   c) Explain the different types of automation with their advantages and disadvantages.

Unit – IV

7. a) Describe with a neat sketch the working of a vapour absorption refrigerator.
   b) Explain the working of reciprocating air compressor with neat sketches.

8. a) Define the following
      i) Air conditioning
      ii) Refrigeration
      iii)condenser
      iv) expansion device
   b) Define refrigerant and name the refrigerants that are commonly used.
   c) Describe the classifications of an air compressor based on different criteria.

Unit – V

9. a) With reference to an open belt drive system, deduce an expression for the belt length.
   b) List the merits and demerits of welding.
   c) A compound gear train consists of 4 gears A, B, C and D having 20, 30, 40 and 60 teeth respectively. A is keyed to the driver shaft and D is keyed to the driven shaft. B and C are compound gears. B meshes with A and C meshes with D. Represent the gear arrangement schematically. If A rotates at 180rpm, what is the rpm of D?

10 a) State when the following types of gear drives are employed:
      (i). Spur gears (ii). Helical gears
   b) Explain the constructional features of a roller bearing with a neat sketch.
   c) (i). Define velocity ratio of belt drives. If d_1 and d_2 are the diameters of the driving and driven pulleys and N_1 and N_2 are their speeds in rpm respectively, deduce an expression for velocity ratio. Assume that there is no relative slip between the pulleys and portions of the belt which are in contact with them.
      (ii). In a belt drive, the ratio of tensions is 2 and the slack side tension is 500N. If the speed and diameter of the driven pulley are 200rpm and 120cm respectively, find the power transmitted.

BT* Bloom's Taxonomy, L* Level

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