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**First/Second Semester B.E. Degree Examination, Dec.08/Jan.09**  
**Elements of Mechanical Engineering**

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer any FIVE full questions, selecting at least TWO questions from each part.  
 2. Answer all objective type questions only in first & second writing pages.  
 3. Answer for objective type questions shall not be repeated.  
 4. Use of steam table is not permitted.

**PART – A**

- 1 a. Choose the correct answer : (04 Marks)
- (i) The centrifugal forces generated by the earth rotation on the far side results in another bulge rise on this side of the earth.  
 (A) Lunar Tides (B) Earth Quakes (C) Volcanoes (D) None.
- (ii) The process in which, using the principle of photovoltaic effect the solar energy is directly converted in to Electrical energy is  
 (A) Helio Thermal process (B) Helio Electrical process  
 (C) Mechanical process (D) None.
- (iii) Babcock and Wilcox Boiler is \_\_\_\_\_ pressure boiler.  
 (A) Low (B) High (C) Medium (D) None.
- (iv) Actual energy stored in the steam is called as  
 (A) Internal latent heat (B) Sensible heat  
 (C) Internal energy of steam (D) latent heat of Evaporation.
- b. With neat sketch explain working of Lanchashire boiler & also show the path of flue gases [Show all 3 views.] (10 Marks)
- c. What amount of heat would be required to produce 4 kg of steam at a pressure of 6 bar and temperature of 250°C from water at 30°C? Take  $C_{pg} = 2.2 \text{ kJ/kgK}$ . Specific heat of water = 4.18 kJ/kgK. At 6 bar  $h_f = 670.4 \text{ kJ/kg}$ ,  $h_{fg} = 2085 \text{ kJ/kg}$ ,  $T_s = 158.8^\circ\text{C}$  (06 Marks)
- 2 a. Choose the correct answer : (04 Marks)
- (i) The high velocity steam particle enters in the turbine blades where it undergoes  
 (A) Change in momentum (B) Change in direction of motion  
 (C) Change in kinetic energy (D) None.
- (ii) Kaplan turbine is a \_\_\_\_\_ turbine.  
 (A) Low head reaction (B) High head reaction  
 (C) Impulse (D) Fire tube
- (iii) Expansion of steam in several stages is called  
 (A) Open cycle gas turbine (B) Closed cycle gas turbine  
 (C) Compounding (D) Impulse water turbine.
- (iv) A prime mover in which the heat energy of the steam is transformed in to mechanical energy directly in the form of rotary motion is called  
 (A) Generator (B) Alternator (C) Steam turbine (D) IC Engine.
- b. With neat sketch explain working of pressure – velocity compounding. (06 Marks)
- c. Differentiate between Impulse and Reaction turbine. (04 Marks)
- d. Explain the working of closed cycle gas turbine with a line diagram. (06 Marks)

4) The wave function for the motion of particles in one dimensional potential box of length  $a$  is given by  $\psi_n = D \sin \frac{n\pi}{a} x$ . Where  $D$  is the normalization constant. The value of  $D$  is

- i)  $\frac{1}{a}$       ii)  $\sqrt{\frac{2}{a}}$       iii)  $a$       iv)  $\sqrt{\frac{a}{2}}$       (04 Marks)

b. Set up time independent schrodinger wave equation. (06 Marks)

c. Write the physical significance of wave function. (04 Marks)

d. A quantum particle confined to one dimensional box of width ' $a$ ' is in its first excited state. What is the probability of finding the particle over an interval of  $(a/2)$  marked symmetrically at the centre of the box? (06 Marks)

3 a. 1) If the mobility of electron in a metal increases the resistivity.

- i) Decreases      ii) Increases      iii) Remains constant      iv) none of these

2) Ohms law relates to the electric field  $E$ , conductivity  $\sigma$  and current density  $\vec{J}$  as

- i)  $\vec{J} = \frac{E}{\sigma}$       ii)  $\vec{J} = \sigma E^2$       iii)  $\vec{J} = \frac{\sigma}{E}$       iv)  $\vec{J} = \sigma E$

3) The average drift velocity  $V_d$  of electrons in a metal is related to the electric field  $E$  and collision time  $\tau$  as

- i)  $\sqrt{\frac{eE\tau}{m}}$       ii)  $\sqrt{\frac{m}{eE\tau}}$       iii)  $\frac{eE\tau}{m}$       iv)  $\frac{m}{eE\tau}$

4) Experimentally specific heat at constant volume  $C_V$  is given by

- i)  $\frac{3}{2}R$       ii)  $10^{-4}RT$       iii)  $\frac{2}{3}R$       iv)  $10^{-4}R$ .      (04 Marks)

b. Write down the assumptions of classical free electron theory. (04 Marks)

c. Explain failure of classical free electron theory. (06 Marks)

d. Find the temperature at which there is 1% probability that a state with an energy 0.5eV above fermi energy is occupied. (06 Marks)

4 a. 1) The unit of dipole moment / unit volume is

- i) Coulomb / metre      ii) Coulomb / metre<sup>2</sup>      iii) coulomb / metre<sup>3</sup>      iv) Coulomb.

2) The flux density is related to the electric field as

- i)  $D = \epsilon + E$       ii)  $D = \epsilon - E$       iii)  $D = \frac{\epsilon}{E}$       iv)  $D = \epsilon E$ .

3) In a solid or liquid dielectric with external applied electrical field, as the electronic polarizability  $\alpha_e$  increases the internal field  $E_i$ .

- i) Increases      ii) Reduces      iii) Remains constant      iv) none of these.

4) In a dielectric, the polarization is

- i) Linear function of applied field      ii) Square function of applied field  
iii) Exponential functions of applied field      iv) Logarithmic function of applied field.

(04 Marks)

b. Derive an expression for internal field in case of one dimensional array of atoms in dielectric solids. (06 Marks)

c. Describe Ferro electrics. (04 Marks)

d. Sulphur is elemental solid dielectric whose dielectric constant is 3.4. Calculate electronic plarizability if its density is  $2.07 \times 10^3 \text{ kg/m}^3$  and atomic wt is 32.07. (06 Marks)

### PART - B

5 a. 1) The emission of photon without being aided by any external agency is called

- i) Light amplification      ii) Induced absorption      iii) Stimulated emission  
iv) Spontaneous emission.

- 6 a. Choose the correct answer : (04 Marks)
- Grinding is also called as  
(A) Twisting (B) Honing (C) Lapping (D) Abrasive machining.
  - In ..... Process the workpiece is fed in the same direction as that of cutter's tangential velocity.  
(A) Horizontal milling (B) Vertical milling (C) Down milling (D) Up milling
  - ..... is the type of artificial abrasive.  
(A) sand stone (B) Corundum (C) Emery (D) Aluminium oxide.
  - Irregular shape of machining is done in  
(A) Angular milling (B) Form milling (C) Gang milling (D) End milling
- b. Draw the neat sketch of Horizontal milling machine & explain parts. (08 Marks)
- c. With neat sketch explain centerless grinding process & also cylindrical grinding process (08 Marks)
- 7 a. Choose the correct answer : (04 Marks)
- The hard filler material used in Brazing is  
(A) Solder (B) Flux (C) Spelter (D) Electrode
  - Resistance of lubricating oil to flow is  
(A) Porosity (B) Electricity (C) Viscosity (D) None.
  - French chalk is  
(A) Filler material (B) Flux (C) Lubricant (D) Solder
  - Support provided for rotating shaft is  
(A) Bearing (B) Lubricant (C) Axle (D) Hook.
- b. Explain with neat sketch flame characteristics of oxy-acetylene gas welding. (08 Marks)
- c. Explain with neat sketch plummer block. (08 Marks)
- 8 a. Choose the correct answer : (04 Marks)
- For converting rotary motion in to rectilinear motion type of gear used is  
(A) Spur gear (B) Rack & pinion (C) Spiral gear (D) Bevel gear.
  - In an open belt drive, to increase the arc of contact of the belt and driven pulley ..... is used.  
(A) Jockey pulley (B) Fast and loose pulley  
(C) Guide pulley (D) Stepped cone pulley
  - The difference between actual speed and that of calculated is  
(A) Creep (B) Slip (C) Gear train (D) Speed ratio
  - The ratio of diameters of driver and driven pulley is called  
(A) Module (B) Pitch circle diameter (C) Ratio of tension (D) Velocity ratio.
- b. Derive an equation for ratio of tension in belt drive. (08 Marks)
- c. Two pulleys of diameter 300mm and 750mm mounted on two parallel shafts 1.5 mts apart are connected by leather belt 150mm width. If maximum safe tension of belt is 14 N per mm width, determine maximum power transmitted in case of (i) Open belt drive (ii) Cross belt drive. Assume speed of the belt as 540 m/min,  $\mu = 0.25$ . (08 Marks)

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