Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– 1st / 2nd EXAMINATION (New Syllabus) – WINTER 2014

Subject code: 2110011 **Date: 02-01-2015**

Subject Name: Physics

Time: 10:30 am - 01:00 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) Attempt the following MCQs: (one mark each). **07**

(1) Force is rate of change of _____.
A) momentum B) work C) velocity D) mass

(2) Kirchhoff's second law is based on the law of conservation of _____.
A) voltage B) charge C) energy D) current

(3) When capalliry placed in water, water level of capalliry rises due to _____.
A) buoyancy C) gravitational force
B) surface tension D) none of the above

(4) Ω·m is the unit of _____.
A) resistivity B) Resistance C) conductance D) conductivity

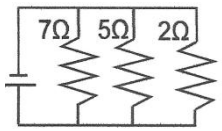
(5) If equilateral triangle having same resistance (R) to all the sides, then the resultant resistance between any two ends is
A) 2R B) R/2 C) 3R/2 D) 2R/3

(6) The direction of buoyancy force is _____.
A) always upward C) depends on liquid
B) always downward D) none of the above

(7) The unit of inductance is _____.
A) Columb B) force C) ohm D) Henry

(b) Attempt the following MCQs: (one mark each). **07**

(1) Determine the equivalent resistance for the below given circuit.



A) 1.4 Ω B) 14 Ω C) 12 Ω D) 1.2 Ω

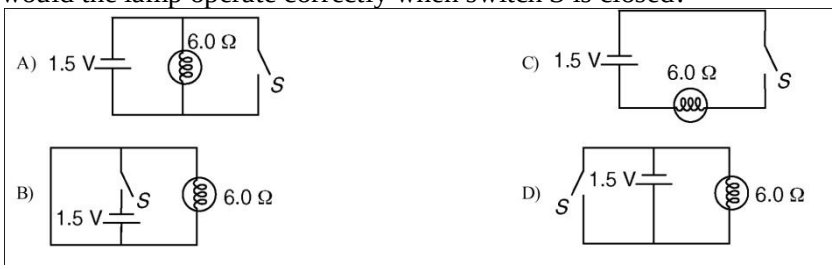
(2) Which one of following is vector quantity?
A) speed B) work C) velocity D) power

(3) According to _____ law of electromagnetic induction, the rate of change of _____ produces induced emf in a closed circuit.
A) faraday's; magnetic flux C) columb's; electric flux
B) faraday's; magnetic field D) columb's; electric field

(4) In a bar magnet, magnetic field lines _____.
A) go from N-pole to S-pole C) magnetic field lines not present
B) go from S-pole to N-pole D) none of the above

(5) If force of 2 dyne is applied on surface area of 2 m^2, then perpendicular pressure acting on it is
A) 10^{-5} N/m^2 B) 10^5 N/m^2 C) 10^4 N/m^2 D) 10^{-4} N/m^2

(6) A 6.0-ohm lamp requires 0.25 ampere of current to operate. In which circuit below would the lamp operate correctly when switch *S* is closed?



(7) Unit of magnetic flux density is _____.
A) Wb/m^2 B) Wb/m C) Wb.m D) Wb.m^2

Q.2 **(a)** An optical fibre has numerical aperture of 0.2 and cladding refractive index of 1.59. Determine the acceptance angle for the fibre in water which has refractive index 1.33. **03**

(b) Explain: Quantum confinement. **04**

(c) **(1)** Write short note on bioceramics. **03**

(2) What are metallic glasses? Write applications of metallic glasses. **04**

Q.3 **(a)** The pulse arrival times from the steel bar of 30 cm thickness during the detection of possible defects using pulse echo method are 30 μs and 60 μs. Find out the distance of defect in a steel bar from the entrance end of ultrasonic waves. **03**

(b) What do you understand by index profile? List out the difference between step and graded index fibre. **04**

(c) **(1)** What do you understand by electronic and ionic polarisability? **02**

(2) What are hard and soft magnetic materials? Compare them on the basis of hysteresis curve, Give examples of each type. **05**

Q.4 **(a)** The critical temperature T_C for Hg with isotopic mass 199.5 is 4.185 K. Calculate the critical temperature for its isotopic mass 204.5. **03**

(b) Derive an expression for Claussius – Mosotti relation and explain the assumptions involved. **04**

(c) **(1)** Define the term nanoparticle. **01**

(2) Describe the ball milling and plasma arcing method to produce nanoparticles. **06**

Q.5 **(a)** What is the resultant sound level in bel, when a 9 bel sound is added to a 90 dB sound? **03**

(b) Write the applications of Carbon nanotubes. **04**

(c) **(1)** Discuss: Maglev effect. **03**

(2) Distinguish between magnetic and optical storage devices. **02**

(3) Mention the advantages of hard disk over floppy disk. **02**

Q.6 **(a)** A silicon material is subjected to a magnetic field of strength 1000 A/m. If the magnetic susceptibility of silicon is -0.3×10^{-5}, calculate its magnetisation. Also calculate the magnetic flux density of the field inside the material. The permeability of free space is $4\pi \times 10^{-7}$ H/m. **03**

(b) **(1)** What is Meissner effect? **01**

(2) Prove that superconducting materials are perfect diamagnetic materials. **03**

(c) Answer the below given questions using Nd-YAG laser.

(1) Draw a schematic diagram of the construction of Nd-YAG laser. **01**

(2) What are the active medium and active centers of the Nd-YAG laser? **01**

(3) Draw the energy level digram. **01**

(4) Write the working of Nd-YAG laser. **03**

(5) Write applications of Nd-YAG laser. **01**

Q.7 **(a)** Calculate the polarisability and relative permittivity in hydrogen gas with a density of 9.8×10^{26} atoms/m^3. Given the radius of the hydrogen atom to be 0.50×10^{-10} m. ($\varepsilon_0 = 8.85 \times 10^{-12}$) **03**

(b) Describe temperature and stress induced transformations in shape memory alloys. **04**

(c) Write the answers of below given questions based on the ultrasonic waves production method using ferromagnetic material.

(1) What is the principle for ultrasonic wave production? **01**

(2) Draw a figure of the oscillatory circuit. **01**

(3) Write the working of the ultrasonic wave production method. **03**

(4) Give merits and demerits of the method. **02**

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