REGISTRATION NO.									

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

II Semester B.Tech. – END SEMESTER EXAMINATION (MAKE-UP)
SUBJECT: ENGINEERING PHYSICS

Duration: 3 hours 18-06-2019 MAXIMUM MARKS: 50

Note: Answer **ALL** the questions.
Write specific and precise answers. Missing data may suitably be assumed.
Draw neat sketches wherever necessary with axes shown properly.

1A. Using a necessary geometry and diagram, obtain an expression for the radii of bright fringes in Newton's rings. [5]

1B. A diffraction pattern is formed on a screen 120 cm away from a 0.400-mm-wide slit. Monochromatic 546.1-nm light is used. Calculate the fractional intensity I/I_{max} at a point on the screen 4.10 mm from the center of the principal maximum. [2]

1C. If the spacing between planes of atoms in a NaCl crystal is 0.281 nm, what is the predicted angle at which 0.140-nm x-rays are diffracted in a first-order maximum? Calculate the angle of incidence of the x-ray beam. [3]

2A. Apply the Schrödinger equation to a particle in a one-dimensional "box" of length L and obtain the energy values of the particle. [5]

2B. We wish to use a plate of glass (n = 1.50) in air as polarizer. Find the polarizing angle and angle of refraction. [2]

2C. Molybdenum has a work function of 4.2 eV. (a) Find the cut off wavelength and cut off frequency for the photoelectric effect. (b) What is the stopping potential if the incident light has wavelength of 180 nm? 1 eV = 1.6×10^{-19} J; Planck's constant "h"=6.63×10^{-34} Js; speed of light in vacuum "c" =3×10^{8} m/s [3]

3A. Explain three types of transitions between two energy levels, when radiation interacts with matter. [3]

3B. A quantum simple harmonic oscillator consists of an electron bound by a restoring force proportional to its position relative to a certain equilibrium point. The proportionality constant is 8.99 N/m. What is the longest wavelength of light that can excite the oscillator? [3]
Planck's constant h=6.63x10^{-34} Js; speed of light in vacuum c =3x10^{8} m/s

3C. Explain photoelectric effect. Which are the features of photoelectric effect-experiment explained by Einstein's photoelectric equation? [4]

4A. Derive an expression for density-of-states [5]

4B. For a H-atom, determine the number of allowed states corresponding to the principal quantum number n = 2, and calculate the energies of these states. [3]

4C. Most solar radiation has a wavelength of 1 μm or less. What energy gap should the material in solar cell have in order to absorb this radiation ? Is silicon (E_g= 1.14 eV) appropriate? [2]
Planck's constant "h"=6.63x10^{-34} Js; speed of light in vacuum "c" =3x10^{8} m/s

5A. With necessary diagrams, explain doping in semiconductors. [4]

5B. The frequency of photon that causes v = 0 to v = 1 transition in the CO molecule is 6.42 x 10^{13} Hz. Ignore any changes in the rotational energy. (A) Calculate the force constant k for this molecule. (B) What is the maximum classical amplitude of vibration for this molecule in the v = 0 vibrational state ? [3]
Atomic masses of C and O are 12u and 16u, respectively. 1u=1.67x10^{-27} Kg;
Planck's constant "h"=6.63x10^{-34} Js; speed of light in vacuum "c" =3x10^{8} m/s

5C. A bismuth target is struck by electrons, and x-rays are emitted. Estimate (a) the M- to L-shell transitional energy for bismuth and (b) the wavelength of the x-ray emitted when an electron falls from the M shell to the L shell. [3]
Atomic number of bismuth=83
Planck's constant "h"=6.63x10^{-34} Js; speed of light in vacuum "c" =3x10^{8} m/s

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