Time : 2 Hours **Total Marks : 60**

N.B :

1) Question number 1 is compulsory
2) Attempt any three questions from Q2 to Q6
3) Use suitable data wherever required
4) Figures to the right indicate full marks for that question

Q.1 Attempt any five Questions out of seven Questions **(3 marks each)**

a) Explain following terms i) Spontaneous emission ii) Population Inversion .
b) What is nanotechnology ? What is its significance ?
c) Compare Laser source with ordinary optical source
d) What is Optical Grating and Grating element ?
e) What are inertial and Non inertial frames of references ?
f) What are transducers ? what is their significance of Transducer in modern technology
g) State applications of the Lasers in Industry and medicine .

Q.2 (a) Explain physical significance of Divergence and Curl of a vector field with suitable Example ? **(5)**

(b) With appropriate schematic diagram explain Method of reconstruction of the Hologram ? **(5)**

(c) Find the fractional increase in mass of a particle moving at velocity given by 0.2c and velocity of particle when mass of particle will be 1.5 times it's rest mass **(5)**

Q.3 (a) Explain with neat diagram construction of Nd-Yag laser **(5)**

(b) Explain the relativistic phenomenon of Time dilation with appropriate mathematical derivation . **(5)**

(c) Explain the use of PT100 as a industrial thermometer **(5)**

Q. 4 (a) A glass clad fibre is made with core glass of refractive index 1.5 and the cladding is doped to give a fractional index difference of 0.0005
Find :
(i) Cladding Index
(ii) The critical internal reflection angle
(iii) The external critical reflection angle
(iv) The numerical aperture **(5)**

(b) Draw the Schematic diagram of Scamming Electron Microscope (SEM) and explain it's working . **(5)**

(c) Derive Maxwell's First equation and state its significance . **(5)**

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Q. 5 (a) Plane waves of wavelength 600nm fall normally on single slit of width 0.2mm. Calculate the total angular width of the central maximum and also the linear width as observed on screen placed 2 cm away. **(5)**

(b) What is difference between Bottom up and Top down approach of synthesis of nanoparticles . **(5)**

(c) What is resolving power of the grating ? Discuss the factors on which it is dependent ? What is significance of resolving power of grating ? **(5)**

Q6. (a) With appropriate diagram explain concept of Pressure sensing by Capacitive method . **(5)**

(b) Find maximum value of resolving power of a diffraction grating 3 cm wide having 5000 lines per cm, if the wavelength of light used is 589 nm. **(5)**

(c) How will you state Faraday's law in differential (in point) form explain with appropriate derivation . **(5)**

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