FE | Sem - II | NEP | All Branch | Dec 2025 | Date - 18/12/2025 (1/2)

Q.P. Code - 99411

Time: 2 Hours **Marks: 60**

i. Question number 1 is compulsory
ii. Attempt any three questions from Q2 to Q6
iii. Assume suitable data wherever required
iv. Figures to the right indicate full marks for that question

Q 1 Attempt any five out of Six (3 marks each) **15**

A Identify whether the vector $\bar{E} = xz\,\hat{\imath} + xy\,\hat{\jmath} + yz\,\hat{k}$ is Solenoidal.

B If a star radiates energy at the rate of 5×10^{20} Js^{-1}, Calculate the rate at which its mass is decreasing.

C Optical fiber has a numerical aperture of 0.20 and the refractive index of the cladding is 1.59. Calculate the acceptance angle of the fiber in water which has a refractive index of 1.33.

D Explain the Stimulated emission in Laser.

E Select the wavelength of light for which the second minimum coincides with the third minimum for the wavelength 4000 Å.

F Explain the method of Ball Milling to prepare nanomaterial.

Q.2. Attempt All Questions **15**

A What is Plane transmission grating? Explain resolving power of the diffraction grating. A plane grating resolves two lines in the second order. Calculate the grating element, if $d\lambda = 6Å, \lambda = 5.5 \times 10^{-5}$cm and the width of the ruled surface is 1.5cm. **8**

B With neat and labelled energy level diagram explain the working of He-Ne laser. **7**

Q.3. Attempt All Questions **15**

A What are Lorentz transformations? Obtain transformation equation for Time dilation. **8**

B What are the different types of Sensors? Explain the Humidity sensor in detail. **7**

Q.4. Attempt All Questions (5 marks each) **15**

A Interpret the conditions for maxima and minima in a single slit Fraunhofer diffraction.

B What is divergence of a vector field? Show that divergence of a curl of vector is zero.

C With a neat labelled diagram explaining the construction and working of a Tunneling electron microscope (TEM).

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Q.5. Attempt All Questions (5 marks each) 15

A Obtain Maxwell's equation which describes how the electric field circulates around the time varying magnetic field in integral form and differential form.

B Explain the Ultrasonic sensor in detail.

C What is Holography? With neat diagram explain the reconstruction process of a hologram.

Q.6. Attempt three questions (5 marks each) 15

A Write applications of nanotechnology in different fields.

B Derive an expression for Numerical Aperture of a step index fiber.

C Differentiate between Step index and Graded Index.
