

## Course outline

How does an NPTEL online course work?

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# Assignment 9

The due date for submitting this assignment has passed.

**Due on 2021-03-24, 23:59 IST.**

As per our records you have not submitted this assignment.

**Instructions:**

1. Answer all questions; all questions carry equal mark.
2. All symbols have their usual meanings.
3. Only one of the options is correct.
4. Take care of the units in numerical problems, to match with the units given in the options (of MCQs), and the units in which answers have to be entered (in fill in the blank type of questions).
5. In the fill in the blank type of questions, only the numerical values have to be entered.

**NOTE:** You can see the correct answers after the last date of submission. Marks obtained in this quiz will be counted towards your final score. You can take the quiz and submit it any number of times, and the latest submitted answers will be taken as your final submission.

- 1) State whether the following statement is TRUE or FALSE:

**1 point**

When a Laser is switched ON, initially spontaneous emission is predominant, but soon stimulated emission overwhelmingly dominates spontaneous emission.

 TRUE

 FALSE

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
TRUE

- 2) The output from a single mode fiber laser is projected on a screen kept at a distance of 10 cm. If the beam diameter of the laser beam observed on the screen is 10 mm, then the angular divergence of the laser beam is \_\_\_\_\_ rad.

(Write your answer up to 3 decimal places)

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Range) 0.095,0.105

**1 point**

- 3) Assume that a He-Ne laser (wavelength 632.8 nm) is designed such that the position of the waist of the lasing Gaussian beam coincides with the output end of the laser. If the beam diameter at the output of the laser is 1.5 mm, then the peak intensity of the laser beam will be halved after travelling a distance of \_\_\_\_\_m from the output end of the laser.

(Write your answer up to 3 decimal places)

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Range) 2.692,2.892

**1 point**

- 4) A Michelson interferometer experiment has to be performed using a laser, emitting greenish- blue light of 500 nm of peak wavelength and a linewidth of 2.5 nm; the two mirrors of the interferometer are kept on a movable mount. If the experiment is to be successfully completed, then the maximum permissible resolution of the mount is \_\_\_\_\_  $\mu\text{m}$ .

(Answer up to 1 decimal place)

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Range) 98.0,102.0

**1 point**

- 5) State whether the following statement is TRUE or FALSE:

**1 point**

A beam of white light (generated from a tungsten-halogen lamp) is incident on a 1 mm thick glass plate - having reflective coatings on both sides. If the transmitted light is measured on a spectrum analyzer, a discrete spectrum comprising of delta-function like peaks of equal spacing throughout the visible light wavelength range will be observed.

 TRUE

 FALSE

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
FALSE

- 6) It is observed that when the intra-cavity etalon of a laser is placed inside the cavity of a particular multimode laser, the output power dropped drastically. Which of the following is not a correct possible explanation for this observation?

**1 point**

- There is no overlap between any resonance frequency of the cavity with that of etalon.
- The resulting loss in the cavity is above the gain of the active medium for all resonance frequencies.
- The etalon is not placed at the proper position along the axis of the cavity.
- The tilt angle of the etalon (w.r.t. the vertical) is not adjusted properly

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
The etalon is not placed at the proper position along the axis of the cavity.

- 7) State whether the following statement is TRUE or FALSE:

**1 point**

The spatial coherence of output beam of a laser decreases if a mode-selective intra-cavity aperture is used because the aperture introduces a high loss for all other modes.

 TRUE

 FALSE

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
FALSE

- 8) Given that a particular laser comprising of spherical mirror resonator supports H-G transverse modes. If a cross shaped metallic grid (i.e., with two perpendicular metallic wires) is used as the intra-cavity aperture, then which of the following lower order transverse modes are filtered out at the laser output?

**1 point**

- TEM<sub>00</sub>, TEM<sub>11</sub>
- TEM<sub>01</sub>, TEM<sub>10</sub>, TEM<sub>11</sub>
- TEM<sub>00</sub>, TEM<sub>01</sub>, TEM<sub>10</sub>
- TEM<sub>00</sub>, TEM<sub>01</sub>, TEM<sub>10</sub>, TEM<sub>11</sub>

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
TEM<sub>00</sub>, TEM<sub>01</sub>, TEM<sub>10</sub>

- 9) A semiconductor laser of 300  $\mu\text{m}$  length, with mirrors of reflectivities of 100% and 99%, is emitting light at wavelength 1  $\mu\text{m}$ , with an output power of 5 mW. If the refractive index of active medium is 3.5, and there are no intra-cavity losses, then the linewidth of the cavity resonance is \_\_\_\_\_ MHz.

(Write your answer up to 2 decimal places)

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Range) 227.35,229.35

**1 point**

- 10) In Q. 9 above, the ultimate linewidth of the laser is \_\_\_\_\_ Hz.

(Write your answer by rounding-off to the nearest integer)

**Hint**

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Range) 10,16

**1 point**