

Subject: mathematics
Branch: physics
Examiner: Isra'a Hadi

Class: 3
Time: 3 hours
Date:

Note: Answer 5 questions, 12 marks for each question.

Q1/ Use power series (up to five terms) to find the solution of the following differential equation:

$$(x^2 - 1)y'' + 3xy' + xy = 0$$

Q2/ Is $f(z) = 2xy + i(x^2 + y^2)$ analytic function or not? Where z is complex number and $f(z)$ is complex function.

Q3/ Find $\int_1^{1.3} e^x + x \, dx$, to three decimal places by Simpson (3/8) rule where $N=3$.

Q4/ Solve the following Partial differential equation:

$$\frac{\partial u}{\partial x} = 3 \frac{\partial u}{\partial y} + \frac{1}{2} u$$

$$u(x,0) = 3e^{-5x} + 2e^{-3x}$$

Q5/ Use Taylor method (up to 4 terms) at three decimal places to find $y(0.2)$ where:

$$y' = x^2 + y \quad y(0) = 1 \quad , \quad h = 0.1$$

Q6/ Evaluate the following integrals in terms of gamma and beta functions:

$$1) \int_0^{\infty} \frac{dy}{1 + y^4}$$

$$2) \int_0^2 y^{3/2} \left(1 - \frac{y}{2}\right)^4 dy$$

GOOD LUCK



(Answer 4 Questions, 15 Marks for each Question)

Q1/ Let $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ Display the results the following commands

- a) Eigen value and Eigen vectors b) Sort columns in ascending order c) sum of diagonal elements
d) Average value of A e) $A(1:2,1:2:3)=1$ f) $A(3:1)=1$ g) determinant of A

Q2) a) use while statement to find the z

$$z = \begin{cases} \sqrt{x} & x \text{ is even} \\ e^x & x \text{ is odd} \end{cases} \quad \text{Where } x = 1, 2, 3, \dots, 10$$

b) Create a matrix c if

$$c = \begin{bmatrix} 1 & 1 & 1 & 1 & 6 \\ 1 & 1 & 1 & 5 & 1 \\ 1 & 1 & 4 & 1 & 1 \\ 1 & 3 & 1 & 1 & 1 \\ 2 & 1 & 1 & 1 & 1 \end{bmatrix}$$

Q3) Consider the following two polynomials

$$a(x) = x^5 + 7x^4 + 6x^3 + x^2 + 1$$

$$b(x) = x^3 + 4x^2 + 0.5x + 1$$

Find using matlab

- 1) Find the roots of b 2) multiply a by b 3) divide a by b 4) derive the polynomial a(x)
5) Find $a(x) + b(x)$ 6) creating symbolic form of b(x) 7) evaluate $a(x)$ at the value $x=4$.

Q4) Create a matlab function called(**se**) to compute the following numbers 1,1,1,3,5,9,17,31,...

Where $s_1=s_2=s_3=1$ find $s_1, s_2, s_3, \dots, s_n$

Q5) a) for the following functions

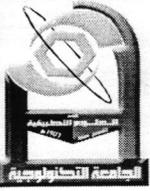
$$y_1 = e^x$$

$$y_2 = \sqrt{x} + xe^x$$

Where

$x = [-0.5 \ 0.1 \ 0.15 \ 0.2]$ plot y_1 and y_2 on same figure window and same y axis and added the title, x and y labels

b) Find the integration numerically and exactly solution by using matlab program for $f(x) = \int_1^2 \sqrt{x} dx$



University of Technology
Department of Applied Sciences
Final Examination 2014/2015



Subject: Laser Principles
Branch: Applied Physics
Examiner: Dr. Uday M. Nayef

Class: 3rd year
Time: 3 hours
Date: /6/2015

Notice: Answer Four Questions.

Q.1 (a)/ What are advantages of four level lasers Compared to three level lasers? (8 marks)

(b) Predict the threshold pumping rate for a KrF laser. The laser has the following properties: $R_1=0.99$, $R_2=0.04$, $L=1$ m, $A_{mode}=5.25$ cm², $\lambda=248$ nm, $\tau_2=5$ ns and $\sigma_{se}=2.6$ °A². Only 15% of pump energy will go into upper state formation? (7 marks)

Q.2 (a)/ Calculate the ratio of the population numbers (N_1 , N_2) for the two energy levels E_2 and E_1 when the material is at room temperature (300 °K), and the difference between the energy levels is 0.5 eV. What is the wavelength of a photon which will be emitted in the transition from E_2 to E_1 ? (7 marks)

(b) What are sources of loss in optical cavity? (8 marks)

Q.3 (a)/ He-Ne laser operating in a single TEM₀₀ mode at 632.8 nm has a mirror separation of 0.5 m with mirrors $R_1=R_2=1$ m, calculate the radius and wavefront curvature of the Gaussian laser beam at a distance of 10m away from the minimum beam radius (w_0) of 0.3mm? (8 marks)

(b)/ Mention the disadvantages associated with Flash lamp pumping? (7 marks)

Q. 4 (a)/ Why gas lasers such as CO₂ or excimer require a gas mixture to generate a laser beam? (7 marks)

(b) Write about the passive Q-switching? (8 marks)

Q.5 (a)/ what is mean the threshold gain coefficient? (5 marks)

(b)/ Write about the properties and propagation of a Gaussian laser beam? (5 marks)

(c) Write about the Alexandrite laser? (5 marks)

Good Luck



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Branch: Physics and Mathematics Science 2014 -2015
Subject: Matlab
Examiner: Lec. Madeha Shaltghag

Class : 3rd year
Time : 3 hours
Date :

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