Tanta University
Faculty of Science
Department of Mathematics

Course Title:	**Algebra 2** (Level 4)	**Course Code: MA4204**
Date: 29-12-2020	**Total Marks: 150**	**Time Allowed: 2 hrs**

Answer the following questions:

Question One: (40 Marks)

a) Let $(A;+)$ be an abelian group,

$A^A = \{f| \ f: A \to A\}$,

$(f+g)(a) = f(a) + g(a)$,

$(f \circ g)(a) = f(g(a))$, $\quad f, g \in A^A$, $\quad a \in A$.

Show that $(A^A ; + ,\circ)$ is a ring and $(End\ A ; + ,\circ)$ is a subring of $(A^A ; + ,\circ)$.

b) Let R be a ring, $a, b \in R$. **Show that** a and b are associate if there is a unit u $(or\ v)$ such that $b = ua$ (or $a = vb$), Then determine all associating elements in $(Z; +,.)$.

Question Two: (35 Marks)

a) Let $\varphi: R \to S$ be a ring homomorphism. **Show That:**

i. If V is a subring of S, Then $\varphi^{-1}(V)$ is a subring of R.

ii. If I is an ideal of R, Then $\varphi(I)$ is an ideal of $\varphi(R)$.

b) Consider the set $\left\{ \begin{bmatrix} a & b \\ -\bar{b} & \bar{a} \end{bmatrix} ; a, b \in \mathbb{C} \right\}$. **Show That** the set with ordinary addition and multiplication of matrices forms a non-commutative division ring.

Question Three: **(40 Marks)**

a) Define the integral domain. Give two different examples of integral domains (not fields).

b) Construct the addition and multiplication tables of the ring (Z_6 ; $+_6$ $\cdot_6$), Then determine the following:

The characteristic of Z_6 - The unit elements - all elements associate to 2- all zero dividors.

Question Four: **(35 Marks)**

a) Let R be a ring, I is an ideal of R, $\pi: R \to R/I$, $r \to r + I$ is the natural map.

If $\varphi : R \to S$ is a ring homomorphism, then **prove that** there is a unique homomorphism $\psi : R/I \to S$ such that $\varphi = \psi \circ \pi$.

b) Apply the first isomorphism theorem to show that

$R[x]/\langle x^2 + 1\rangle \cong C$.

(Hint: Consider the map $\varphi : R[x] \to C$, $g(x) \to g(i)$)

Examiners:

Dr. Tahany Elsheikh

Tanta University
Faculty of Science
Department of Mathematics

Examination	Level Four – Mathematics		
Course Title: Electrodynamics		Course Code:	MA4218
Time: 30/ 12/ 2020	Term: First	Total Assessment Marks: 150M	Time Allowed: 2H

Answer the following questions:

First question: (35 Marks)

(a) Find the amplitudes of the Reflection and transmitted waves at the boundary of two media.

(b) A circular loop described by the equation $x^2 + y^2 = 16$ is located in the x-y plane centered at the origin. The field is given by $\underline{B} = 2\sqrt{x^2 + y^2}\cos(\omega t)\,\hat{\underline{k}}$. Find the total emf induced in the loop.

Second question: (40 Marks)

Discuss the propagation of uniform plane waves in free space for both the electric and magnetic field.

Third question: (35 Marks)

(a) Consider a simple magnetic field which increases exponentially with time $\underline{B} = B_0\ e^{bt}\hat{\underline{k}}$, where B_0 is a constant. Find the electric field E by this varying field, and the poynting's vector P.

(b) Discuss the wave propagation in free space in one dimensional.

Fourth question: (40 Marks)

Discuss the plane waves in imperfect dielectric and conductors, and find for all cases of good conductors and poor conductors the poynting's vector P.

With best wishes
Prof. Dr. Ahmed Abo-Amber
Dr. K.M. Elmorabie

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF MATHEMATICS			
	EXAMINATION FOR FOURTH YEAR (MATHEMATICS) SCIENCE STUDENTS			
1969	COURSE TITLE:	OPERATION RESEARCH (1)		COUSE NO. MA 4105
DATE:	13/1/2021	FREST TERM	TOTAL ASSESSMENT MARKS:150	TIME ALLOWED: 2 H.

<u>ANSWER THE FOLLOWING QUSETION</u> **<u>(OPERATION RES:</u>**

[1] (a) If M and S are two convex sets prove that: M+S, M-S and αM are convex sets?

(b) Draw and examine the convexity of the sets

$$M_1=\{(x_1,x_2)\in R^{+2}: x_1^2+x_2^2\le a^2,\quad x_1+x_2\ge a,\quad a>0\},$$

$$M_2=\{(x_1,x_2)\in R^{+2}: x_1-4x_2^2\le 0,\quad x_1\le a,\quad a>0\}.$$

(40 deg.)

[2] (a) Prove that: The positive semi-definite quadratic form $f(X)=X^TCX$ is a convex function for all X in R^n. (20 deg.)

(b) If f(X) is differentiable in on a convex set M, then $f(X)$ is convex iff

$$f(x_1)-f(x_2)\ge(x_1-x_2)^T\nabla f(x_2)\quad \forall x_1,x_2\in M$$

(15 deg.)

[3] (a) Determine the definiteness of the quadratic form of: (20 deg.)

$$i-f(x_1,x_2)=x_1^2+2x_1x_2-x_2^2,$$

$$ii-f(X)=x_1^2+x_2^2+x_3^2+2x_1x_2$$

(b) Find the maximum or minimum value of the functions

$$f(X)=x_1^2+x_2^2+x_3^2-4x_1-8x_2-12x_3+56$$

(15 deg.)

[4] (a) Use the univariate method to

$$\min f(x_1,x_2)=x_1-x_2+2x_1^2+2x_1x_2+x_2^2$$

with the starting point $(0,0)$ and probe length $\theta=0.01$. (20 deg.)

(b) Use newton method to minimize

$$f(X)=-x_1-2x_2+6x_1^2-6x_1x_2+2x_2^2$$

with the starting point at (0,0). (20 deg.)

بالتوفيق

أ.د. السعيد عمار

1969	Tanta University Faculty of Science Department of Mathematics		
	Final term exam for the First semester 2020-2021		
	Course title:	Operations Research (1)	**Course code:** MA4105
	Date:6/3/2021	Total Marks: 150	**Time allowed:** 2 Hours

Answer all the following questions:

First question: (40 Marks)

(a) For Linear Programming define the following:
"convex set, convex function, extreme point, feasible solution, optimal solution" .
(b) Discuss the convexity of the following sets

$(i)\ S=\{(x,y):|x|\le 2, |y|\le 1\}\subset R^2 \quad (ii)\ S=\{(x,y):y^2\le x\}\subset R^2$

(c) Let S and T be two convex sets in R^n, then for any scalars α,β, $\alpha S+\beta T$ is also convex.

Second question: (35 Marks)

(a) Solve graphically the following LPP:

$\max z=6x_1+7x_2 \ \ s.t.\ \ 2x_1+3x_2\le 12,\ 2x_1+x_2\le 8,\ \ x_1,x_2\ge 0$

(b) By Simplex method solve the following LPP:

$$\begin{aligned} &\max z=x_1-x_2+3x_3\\ s.t.\ \ &x_1+x_2+x_3\le 10\\ &2x_1-x_3\le 3\\ &2x_1-2x_2+3x_3\le 0\\ &x_1,x_2,x_3\ge 0 \end{aligned}$$

Third question: (35 Marks)

(a) State and prove the weak Duality theorem?
(b) Consider the following L.P.P.

$$\begin{aligned} \max\quad &z=x_1+2x_2+3x_3+4x_4\\ s.t.\ \ &x_1+2x_2+2x_3+3x_4\le 20.\\ &2x_1+x_2+3x_3+2x_4\le 20\\ &x_1,x_2,x_3,x_4\ge 0 \end{aligned}$$

(i) Write the Dual of the problem?
(ii) Apply the weak Duality theorem?

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Fourth question: (40 Marks)

(a) Explain the Transportation problem?.

(b) By using North West Corner Rule find an initial basic feasible solution for the following transportation problem:

	d_1	d_2	d_3	d_4	
S_1	10	0	20	11	15
S_2	12	7	9	20	25
S_3	0	0	16	18	5
	5	15	15	10	

Examiners:	Prof. H. Kamal	Dr. N. El-Kholy

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TANTA UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

Final Term Exam for the First Semester 2020-2021

Course Title:	**Quantum Mechanics**	**Course Code:** MA4115
Date: 8-3-2021		**Time Allowed:** 2 Hours

Answer all the following questions:

First question:

a- Derive schroedinger equation in one direction (x) with different values of potential energy V(x)?

b- Prove that $[x, p_x] = i\hbar$ and $[x, L_x] = 0$

Second question:

a) Prove that $[p_x, L_z] = -i\,\hbar\, p_y$

b) Derive the condition of superposition $(|a_n|^2 + |a_m|^2 = 1)$

Third question:

a) Deduce the Uncertainty princple $\Delta x.\ \Delta p_x \geq \frac{\hbar}{2}$

b) Derive the continuity equation $\left(\frac{\partial \rho}{\partial t} = -\nabla . J\right)$

(Best wishes)

Examiners:	**1- Prof. Dr. Ahmed Abo Anbar 2- Dr. Afaf Mohamed Farag**

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF MATHEMATICS			
	FINAL EXAMINATION FOR FOURTH YEAR OF MATHEMATICS			
	COURSE TITLE:	TOPOLOGY 2		COURSE CODE:MA 4111
DATE:	18/1/2021	TERM: FIRST	TOTAL DEGREE : 100	TIME ALLOWED: 2 HOURS

Answer All the Following Questions

1st Question:- (40)

a − *Define the spaces* T_i, *where*

$i = \{0,1,2,3,4\}$ *and give the relation between the and give an example for every one.* **(10)**

b- Give an example for **(10)**

1- Compact space and another for not compact.

2 − T_1 **− space but not** T_2 *− space.*

3- T_o *− space but not* T_1 *− space.*

4 −Normal space but not T_4 *− space* .

5-Dis*connected space another connected space.*

c- Prove that a closed subset A of compact space X is compact . **(10)**

d-Prove that the image of connected space X under continuous mapping $f : (X,\tau) \to (Y,\sigma)$ *is conneceted.* **(10)**

2nd Question:- (30)

a-Prove that every T_4 *- spac is* T_2 *−space .* **(10)**

b-Prove that the property of T_2' *− space* **is hereditary property.** **(10)**

c-Prove that the a space is T_1 **− space iff for every x** ϵ**X,** $\{x\}' = \emptyset$. **(10)**

3rd Question:- (30)

a- Prove that every T_4 *− space is* T_2' *− space.* **(10)**

b- Prove that the co finite space is T_1 **− space but not** T_2 *−space* . **(10)**

c- Prove every compact regular space is normal . **(10)**

EXAMINER	Dr/ Bothina Taher	Dr/ Abd Elftah Alatik

مع أطيب الأماني بالنجاح والتفوق

TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF MATHEMATICS		
EXAMINATION FOR PROSPECTIVE STUDENTS (4TH YEAR) STUDENTS OFMATHEMATICS		
COURSE TITLE:GENERAL RELATIVITY		COURSE CODE:MA4113
DATE:23 /1/2021	TERM:SUMMER	TOTAL ASSESSMENT MARKS:	TIME ALLOWED: 2HOURS

[1] (a) If a contravariant tensor has the components $\ddot{r} - r\dot{\theta}^2$ and $\ddot{\theta} + 2\dot{r}\dot{\theta}/r$ on polar coordinates (r,θ). Find its components in Cartesian coordinates (x,y).

(b) Prove that $V^{\sigma}_{;\mu}$ is tensor of rank two .

(c) Drive the Bianchi *identities.*

[2] (a) Prove that if the equation $K(ij)A_{jk} = B_{ik}$ holds for all the coordinates systems then $K(ij) = K_i^j$

(b) Find the fundamental metric and $[22,1]$, $[12,2]$, $\{22,1\}$, $\{12,2\}$ to the metric

$ds^2 = a^2 d\theta^2 + a^2 \sin^2\theta d\varphi^2$

[3] (a) Find the transformation law and state if tensor or no for the quantity:

i) $\frac{\partial A_i}{\partial x^j} - \frac{\partial A_j}{\partial x^i}$

ii) $\{\mu\nu,\sigma\}$

(b) Prove that

i) $V^{\lambda}_{;\lambda} = \frac{1}{\sqrt{-g}} \frac{\partial}{\partial x^{\lambda}} \sqrt{-g} V^{\lambda}$

ii) $\Gamma^{\lambda}_{\nu\lambda} = \frac{1}{\sqrt{-g}} \frac{\partial}{\partial x^{\nu}} \sqrt{-g}$

iii) The covariant derivative of the matric tensor is zero.

[4] (a) derive the Geodesic equations.

(b) Complete $A^{\delta\varepsilon\rho}_{\alpha\beta;\sigma}$ =................. and $A^{\alpha}_{\rho;\sigma\delta}$=............................

Dr. Mohamed Khalifa

EXAMINERS	DR./MOHAMED ABDOU KHALIFA	PROF./
	PROF./ MOHAMED OMER SHAKER	DR/

With my best wishes

TANTA UNIVERSITY FACULTY OF SCIENCE - MATHEMAICS DEP.			
EXAMINAION FOR			
COURSE TITLE: FLUID MECHANICS (1) MA4103			TIME ALLOWED:2 HOURS
DATE: MARCH 2021	TERM: FIRST	TOTAL ASSESSMENT MARKS: 150	

Answer the following questions:

1A. A two dimensional fluid flow velocity

$u = x^2 + (y)^{x+1}, \quad v = y^2 + (x)^y, \quad w = 0$

Calculate the acceleration components a_x, a_y, and a_z by using Lagrange and Euler methods.

1B. Calculate and plot the stream and path lines for fluid flow velocity

$u = 0, \quad v = y^2 t, \quad w = zt$

Passing through the point (0,y , z) at t=0.

[35 Marks]

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2. The pressure field is a function of density, velocity, viscosity, and surface tension .Find the relation between theses parameters by using:

A. Power-product method

B. Pi-theory [Hint: The basic parameters are density, velocity, and surface tension] [35 Marks]

3A. Derive the continuity conservation equation on the basis of basic concepts

3B. Derive Bernoulli's equation [40 Marks]

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4. Calculate and plot the stream function $\Psi(x, y)$ and velocity potential $\Phi(x, y)$ for the fluid velocity in the following two cases:

A: $u = x^2 - 2yx$ and $v = -2yx + y^2$

B: $u = 3y^2 - 2yx^2$ and $v = xy - 3y^2$ [40 Marks]

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With best wishes

Questions Committee:

1.Prof. Dr. Selim Ali Mohammadein 2. Dr. Magdy El-Tantawy