| | TANTA UNIVERSITY<br>FACULTY OF SCIENCE<br>DEPARTMENT OF MATHEMATICS | | |
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| | EXAMINATION FOR PROSPECTIVE STUDENTS (4TH YEAR) STUDENTS OFMATHEMATICS | | |
| | COURSE TITLE:GENERAL RELATIVITY | | COURSE CODE:MA4113 |
| DATE:27/12/2016 | TERM:FIRST | TOTAL ASSESSMENT MARKS: | TIME ALLOWED: 2HOURS |

~~Answer fife questions:~~

[1] (a) Prove that $ds^2 = dx^2 + dy^2 + dz^2$ in parabolic coordinates $(\xi, \eta, \varphi)$ given as

$$ds^2 = (\xi^2 + \eta^2)d\xi^2 + (\xi^2 + \eta^2)d\eta^2 + \eta\xi d\varphi^2$$

where $x = \xi\eta\cos\varphi, \quad y = \xi\eta\sin\varphi, \quad z = (\xi^2 - \eta^2)/2.$

(b) When $A_i$ is a vector, find and prove that the transformation law for $B_{ij} = \frac{\partial A_i}{\partial x^j} - \frac{\partial A_j}{\partial x^i}$ is tensor

[2] (a) The equation $K(ij)A_{jk} = B_{ik}$ holds for all the coordinates systems. If $A$ and $B$ are second-rank tensors, show that $K$ is a second tensor also.

(b) Use the question [3] (b) and Obtain the equations of the geodesic for the same metric

[3] (a) Prove that $B_{i;j}$ is tensor of rank two and Riemann-Christoffel's tensor $B^{\rho}_{\mu\nu\sigma}$.

(b) Find the fundamental metric and Christoffel's symbols to the metric

$$ds^2 = dt^2 - e^{2kt}\left(dx^2 + dy^2 + dz^2\right)$$

*Dr. Mohamed Khalifa*

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كلية العلوم - جامعة طنطا
QUALITY ASSURANCE UNIT
FACULTY OF SCIENCE - TU

| EXAMINERS | DR./MOHAMED ABDOU KHALIFA | DR/ |
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| | PROF./ SLIM ALI MOHAMMADEIN | DR/ |

*With my best wishes*

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| Tanta University<br>Faculty of Science<br>Mathematics Dept.<br>Year: 4<br>Pages of questions: only one page | Subject: Topology 2 | Date: 1/1/2017<br>Time allowed: 3 h<br>Full Degree: 150 |

## Answer the following questions

### Question 1:

1. Prove that a continuous one-to-one function from a compact space onto a Hausdorff space is homeomorphism.
2. Show that every subset from a co-finite topology is compact.

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### Question 2:

1. Prove that every compact Hausdorff space is $T_4$.
2. For a continuous mapping $f: (X, \tau_1, T_1) \to (Y, \tau_2)$. Prove that the inverse image of points in $Y$ is closed set in $X$.

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### Question 3:

1. State with proof Hein-Borel Theorem.
2. If $X = \{a, b, c\}$ with a topology $\tau = \{X, \varphi, \{a\}, \{b, c\}\}$. Discuss the regularity, normality, $T_3$ and $T_4$.

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### Question 4:

1. For every topological space $(X, \tau)$ and $A \subset X$, prove that X is compact iff for all $\Im$ of closed subsets of X having a finite intersection property has $\cap \Im \neq \emptyset$.
2. Prove that the usual topology is Hausdorff.

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### Question 5:

1. Prove that a space $X$ is $T_1$ iff for every singleton is closed.
2. If $X = \{a, b, c, d\}$ with a topology
   $\tau = \{X, \varphi, \{c\}, \{b, c\}, \{a, b, c\}, \{b, c, d\}\}$. Discuss $T_0'$ , $T_1'$, $T_1''$ and $T_2''$

With best wishes

Dr. Abd El-Fattah El-Atik

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| | TANTA UNIVERSITY | | | |
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| | | FACULTY OF SCINCE - MATHEMATICS DEP. | | |
| | FOURTH YEAR, | MA4103 | | |
| | | FLUID MECHANICS 1 | | |
| DATE: 5 JAN. 2017 | TERM: FIRST | TOTAL ASSESSMENT MARKS: 150 | TIME ALLOWED: 2 HOURS | |

Please answer the following questions

1A. The velocity of fluid flow in 2D is given by

$V = yz\,\underset{\sim}{i} + yt\,\underset{\sim}{j} + z\underset{\sim}{k}$

**through a surface of vertices (0 , 5 ,7 ), (0, 11, 7 ), and (0, 8, A1). If the volume flux Q =918 ($L^3\ T^{-1}$), then** calculate the constant A1, kind of surface, and average velocity.

1B. Calculate the acceleration components $a_x$ and $a_y$ of fluid flow by Euler and Lagrangian methods for fluid velocity

$$V = x^t \underset{\sim}{i} + t^x \underset{\sim}{j}$$

[45 Marks]

2A. The fluid velocity is a function of fluid density $\rho$, gravity g, depth h, and time t . Rewrite the relation between these parameters using Pi theory. [Hint: $\rho$, **h, and g,** are basic parameters]

2B. Find the non-dimensional form of the following equation

$$\rho \frac{dV}{dt} = \mu \frac{d^2 V}{dx^2} - \int dP - \frac{\gamma}{R}$$

and then find the non-dimensional numbers [35 Marks]

3A.If the velocity potential $\Phi = 2xy$ , find and plot $\psi$(x, y),and path line

3B. For the 2D fluid flow, find and plot $\psi$ for two components velocities

, $u = 3 + e^{-x}$ , $v = 3 - e^{y}$

[35 Marks]

4. The velocity components of fluid flow $u=3(x^2-z^2)$, v=0 , w=-6xz satisfied the solution of Navier-Stokes equations. Find the pressure distribution.[Hint: $g_x=g_y=0$, $g_z=-g\,\underline{k}$ ] [35 Marks]

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بالتوفيق و النجاح

لجنة الأسئلة: أ.د.سليم على محّدين. أ.د.مجدى سرواح.

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TANTA UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF MATHEMATICS

EXAMINATION FOR COMPUTER SCIENCE (FOURITH YEAR) STUDENTS

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| COURSE TITLE: | OPERATION RES. (1) | | COURSE CODE: MA ~~3103~~ 4105 |
| DATE: 17/1/2017 | TERM: SECOND | TOTAL ASSESS. MARKS: 150 | TIME ALLOWED: 2 H. |

***ANSWER THE FOLLOWING QUSETION:***

[1] Find the set of all feasible solution and determine the optimal one graphically of the LP: (35 deg.)

$$LP \begin{cases} \max \quad z = -x_1 + 2x_2 \\ \text{s.t.} \quad x_1 + 2x_2 \le 20, \qquad 2x_1 + x_2 \le 30, \\ \quad 1.5x_1 - 5x_2 \le 15, \qquad x_1, x_2 \ge 0. \end{cases}$$

[2] By simplex method solve of linear program: (40 deg.)

$$(LP): \begin{cases} \min z = -5x_1 + 2x_2 - 3x_3 \\ \text{s.t.} \quad 2x_1 + 2x_2 - x_3 \ge 2, \\ \quad 3x_1 - 4x_2 \le 3, \\ \quad x_2 + 3x_3 \le 5, \\ \quad x_1, x_2, x_3 \ge 0 \end{cases}$$

[3] By simplex method solve of following dual linear program: (35 deg.)

$$(D): \begin{cases} \min W = -2x_1 + 3x_2 + 5x_3 \\ \text{s.t.} \quad -2x_1 + 3x_2 \ge 5, \\ \quad -2x_1 - 4x_2 + x_3 \ge -2, \\ \quad x_1 + 3x_3 \ge 3, \\ \quad x_1, x_2, x_3 \ge 0 \end{cases}$$

[4] By minimum cost method and Vogel method solve of the transportation problem: (40 deg.)

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| Supply | 4 | 7 | 13 | 9 |
| 6 | 14 | 25 | 45 | 24 |
| 8 | 60 | 25 | 39 | 50 |
| 16 | 30 | 23 | 65 | 15 |

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| EXAMINERS | PROF. E. AMMAR | GOOD LOKE |

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| | TANTA UNIVERSITY<br>FACULTY OF SCIENCE<br>DEPARTMENT OF MATHEMATICS |
| | EXAMINATION FOR PROSPECTIVE STUDENTS ($4^{TH}$ YEAR) STUDENTS OF MATHEMATICS |
| | COURSE TITLE: QUANTUM MECHANICS II / COURSE CODE: MA4115 |

| DATE: 10 | JAN 2017 | TERM: FIRST | TOTAL ASSESSMENT MARKS: 100 | TIME ALLOWED: 2 HOURS |
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**Answer the following questions:**

1- Complete the following statements: (30 Marks)

a) A set of vectors $\{\Phi_n\}$ is said to linearly independent if ......................................................................................

b) The maximum number of linearly independent vectors in a space is called ......................

c) $\hat{D}$ is called a linear operator if and only if ................................ and ...................................

d) If $\hat{A}$ is a Hermitian operator, then all of its eigenvalues are ..........................

e) Eigenvectors corresponding to distinct eigenvalues of a Hermitian operator must be ......................

f) The matrix elements of the operator $\hat{M}$ are defined as ..........................

g) The square angular momentum operator in spherical coordinates takes the form ....................................................................................

h) The mathematical formula of the creation and annihilation operators are ....................................and ........................................

2- a) Use the creation and annihilation operators to find the expectation values $\langle x\rangle$ and $\langle x^2\rangle$. (15 Marks)

b) Find the Pauli spin matrices. (15 Marks)

c) Discuss the time independent perturbation theory. (15 Marks)

3- Drive the radial wave functions. (25 Marks)

| EXAMINERS | PROF/AHMED ABOANBER | DR/ ABDALLAH A. NAHLA |
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| | DR/ | DR/ |

*With my best wishes*

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| Tanta University-Faculty of Science-Department of Mathematics | | |
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| Final Exam for the First Semester 2016-2017 | | |
| **Course title:** | Differential geometry(1) | **Course Code:** MA4107 |
| **Date:** 15 /1 /2017 | **Total mark:** 150 Marks | **Time allowed:** 2 Hours |

**Answer all the following questions:**

**First question: (40 Marks)**

(a)-Prove that $\tau = -\frac{(\alpha'(s) X \alpha''(s)).\alpha'''(s)}{k^2(s)}$

(b)-Let $\alpha(t)$ be the parameterized curve of $R^3$ defined by

$$\alpha(s) = (a \cos\frac{s}{\sqrt{a^2+b^2}}, a \sin\frac{s}{\sqrt{a^2+b^2}}, \frac{bs}{\sqrt{a^2+b^2}})$$

Compute k,τ , t, nand b .

**Second question: (40 Marks)**

(a)-Drive Frenet equations.

(b)-Prove that $X(u,v)$ is a simple surface, where U is open set and

$X(u,v) = (u,v,f(u,v))$

(c)- Find the equation of the tangent line of the circular helix at t=0 , where

$$\alpha(t) = (a \cos t, a \sin t, bt)$$

**Third question: (40 Marks)**

(a)- Show that the distance between corresponding points on two Bertrand curves is constant.

(b)- Prove that for a plane curve $\int_0^l k(s)ds = 2\pi I$.

(c)-Find the parameterization of the curve $x_3^2 = 1 - x_1$ , $x_2^2 = x_1$.

**Fourth question: (30 Marks)**

(a)- Let $\alpha(t) = (t, \frac{1}{2}t^2, \frac{1}{3}t^3)$.Compute k,τ at t=1.

(b) -Let α: I→ $R^3$ be a regular parameterized curve. Prove that $\frac{dt}{ds} = \frac{1}{|\dot{\alpha}|}, \frac{d^2t}{ds^2} = -\frac{\dot{\alpha}.\ddot{\alpha}}{|\dot{\alpha}|^4}$

( c) Find the curvature of the curve $x^2$=4ay.

**(Best wishes)**

| **Examiners:** | **1- Prof. Dr. A. E. El-Bagoury** | **2- Dr. Mervat Elzawy** |
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الرياضيات

| Tanta University-Faculty of Science-Department of Mathematics | | |
|---|---|---|
| Final Exam for the First Semester 2016-2017 | | |
| **Course title:** | Differential geometry(1) | **Course Code:** MA4107 |
| **Date:** 15 /1 /2017 | **Total mark:** 150 Marks | **Time allowed:** 2 Hours |

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**First question: (40 Marks)**

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Compute k,τ , t, nand b .

**Second question: (40 Marks)**

(a)-Drive Frenet equations.

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( c) Find the curvature of the curve $x^2$=4ay.



**(Best wishes)**

| **Examiners:** | **1- Prof. Dr. A. E. El-Bagoury** | **2- Dr. Mervat Elzawy** |
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