Tanta University
Faculty of Science
Math. Department

Topic: Theoy of Elasticity
Date: 12-01-2013
Time: 3 hours
4th Year

First Semester Exam. (Jan. 2013)

Please answer the following questions:

1 (a) Derive the surface conditions for a stresses acting on area inclined to the co-ordinate planes

(b) for a stress tensor τ Calculate: H, (H), Λ, N_i and l_i, m_i, n_i

$$\tau = \begin{pmatrix} 7 & 0 & -3 \\ 0 & 4 & 0 \\ -3 & 0 & 6 \end{pmatrix}$$

2 Derive τ_{uu}, τ_{uv} and τ_{uw} in general form and then in plane yx at $\alpha = \frac{\pi}{2}$ Calculate τ_{uu}, τ_{uv} and τ_{uw}. [Plot your answer]

3 (a) Derive e_{xh}, e_{yh}, e_{zh} in terms of u, v, and w

(b) when $u = xyz^2$, $v = y^2 z$, and $w = x^2 y^2$ Calculate e_{xh}, e_{yh}, and e_{zh} at point $(1,2,1)$, $l = m = n$

4 (a) Derive the differential eq^ns of equilibrium in plane (r, θ)

(b) On the basis of Fourier's method, prove that the longitudinal vibrations of a Bar satisfy $\frac{\partial^2 u}{\partial t^2} = \frac{E}{\rho} \frac{\partial^2 u}{\partial x^2}$

5 (a) On the basis of elasticity principals prove that

$$\tau_{xx} = \lambda\theta + 2\mu e_{xx}$$
$$\tau_{yy} = \lambda\theta + 2\mu e_{yy}$$
$$\tau_{zz} = \lambda\theta + 2\mu e_{zz}$$

(b) Calculate Lame's coefficients λ, μ, E, K when $\sigma = 0.3$, $u = -2x+1$, $v = 3y+1$ and

$$\tau = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 5 & 4 \\ 3 & 4 & 0 \end{pmatrix}$$

with best wishes

Tanta University Faculty of Science	Probability Theory Examination	Time: 3 hours January 2013

Answer the following questions

1- (a) Prove that if (X,Y) has a bivariate normal distribution, then X and Y are independent if and only if X and Y are uncorrelated.

(b) Given two random variables (r.v.'s) X and Y with joint probability mass function

y \ x	0	1	2
0	0.1	0.1	0
1	K	0.2	0.1
2	0	0.1	0.1
3	0.1	0	0.2

Find: K , *the correlation coefficient* $\rho(X,Y)$ and $E(X/Y=2)$.

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2-(a) Find the characteristic function of the random variable $Y=(X-np)/\sqrt{npq}$, where X follows the binomial distribution.

(b) Suppose that the joint probability density function (p.d.f.) of X and Y is given by

$$f(x,y)=4y(x-y)e^{-x-y},\ 0\le x<\infty,\ 0\le y\le x.$$

Compute $E(X/Y=y)$.

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3- (a) If the probability mass function (p. m. f.) of the random variable X is

$$f_x(x)=\frac{3}{4}\left(\frac{1}{4}\right)^{x-1},x=1,2,3,\ldots,$$ then find the p. m. f. of $Y=X^2$.

(b) If the joint probability mass function of the discrete r. v.'s X and Y is $$f(x,y)=\frac{\lambda^y}{(y-x)!\,x!}e^{-2\lambda},x=0,1,2,\ldots,y \text{ and } y=0,1,2,\ldots,$$

then calculate $f_y(y)$ and the conditional variance of X given that $Y=3$.

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4- (a) If $X_1,X_2,\ldots,X_n$ are independent and identically distributed r.v.'s having an exponential distribution with parameter μ, then find the distribution of

$$Z=X_1+X_2+\ldots+X_n.$$

(b) Let X_1 and X_2 be a random sample of size 2 from the distribution having p. d.f. $f(x)=e^{-x}$, $x>0$.

Find the p. d. f. of $Y=X_1+X_2$ and the p. d. f. of $Z=\dfrac{X_1}{X_1+X_2}$.

مع أطيب الأماني بالنجاح والتوفيق

TANTA UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF MATHEMATICS

EXAMINATION FOR PROSPECTIVE STUDENTS (4^{TH} YEAR) STUDENTS OF MATHEMATICS

COURSE TITLE: GENERAL RELATIVITY & ELECTRODYNAMICS			COURSE CODE: 14016	
DATE:16	JAN, 2013	TERM: FIRST	TOTAL ASSESSMENT MARKS: 63	TIME ALLOWED: 3 HOURS

Answer 5 questions only:

1- i) Consider the boundary between free space and a perfect dielectric having $\varepsilon_r = 9, \mu_r = 1$ and $\sigma = 0$. If a uniform plane wave $\underline{E_I} = \cos(\omega t - \frac{4\pi}{3} z)\, \underline{\hat{\imath}}$ and frequency of 200MHz is incident from free space normal to the dielectric. Find the time domain forms of the reflected and transmitted fields.

ii) Consider an electric field $\underline{E} = E_0\, r\, e^{-at}\, \underline{\hat{k}}$, where E_0 is constant. Find the magnetic field produced by this varying field.

2- Derive the reflection and transmission coefficient through linear media.

3- Discuss the TM waves guided by a rectangular guide.

4- Discuss Einstein field equations, then by using the Bianchi identity:

$$R^{n}_{i\,j\,k//l} + R^{n}_{i\,k\,l//j} + R^{n}_{i\,l\,j//k} = 0, \qquad \text{Prove that} \qquad G^{i}_{j//i} = 0$$

5- i) Using $\left(A_i\, B_j\right)_{//k} = A_i\left(B_{j//k}\right) + \left(A_{i//k}\right) B_j$ determine $A_{i\,j//k}$, $\left(A_{i//j}\right)_{//k}$

ii) Prove that the derivative of a scalar function is a covariant vector (tensor).

iii) Show that $g^{\alpha\beta} g_{\alpha\beta} = n$ for n-dimensional space.

6- Prove that i) $\Gamma^{i}_{j\,k} = \frac{\partial}{\partial x^k} \ln\sqrt{g}$

ii) $[p\,q, r] = [q\,p, r]$

iii) $[p\,q, r] = g_{r\,s}\,\Gamma^{s}_{p\,q}$

EXAMINERS	PROF. DR/MOHAMED O. SHAKER	DR/ MOHAMED M. SHAHIN
	DR/ ABDALLAH A. NAHLA	DR/

With my best wishes