Faculty of Mechanical Engineering
Universiti Malaysia Pahang

BMM4893 Mechanics of Composite Materials
Assignment No.3

Answer all questions. Important note: This assignment must be *in handwriting*, no MS Word/Latex etc.

Find the 4 elastic modulus and 5 strength parameters of lamina with 55% fiber volume fraction, for each of a unidirectional

a) glass/epoxy
b) aramid/epoxy
c) graphite/epoxy

Use the Halphin-Tsai equations and properties from tables below:

Typical Mechanical Properties of Fibers

Property	**Units**	**Graphite**	**Glass**	**Aramid**
Axial modulus	GPa	230	85	124
Transverse modulus	GPa	22	85	8
Axial Poisson's ratio		0.3	0.2	0.36
Transverse Poisson's ratio		0.35	0.2	0.37
Axial shear modulus	GPa	22	35.42	3
Coefficient of thermal expansion	μm/m/℃	-1.3	5	-5
Coefficient of moisture expansion	m/m/kg/kg	7	5	4.1
Axial tensile strength	MPa	2067	1550	1379
Axial compressive strength	MPa	1999	1550	276
Transverse tensile strength	MPa	77	1550	7
Transverse compressive strength	MPa	42	1550	7
Shear strength	MPa	36	35	21
Specific gravity		1.8	2.5	1.4

Source: Tsai, S.W and Hahn, H.T., Introduction to Composite Materials, CRC Press

Typical Mechanical Properties of Matrices

Property	Units	Epoxy	Aluminum	Polyamide
Axial modulus	GPa	3.4	71	3.5
Transverse modulus	GPa	3.4	71	3.5
Axial Poisson's ratio		0.3	0.3	0.35
Transverse Poisson's ratio		0.3	0.3	0.35
Axial shear modulus	GPa	1.308	27	1.3
Coefficient of thermal expansion	μm/m/°C	63	23	90
Coefficient of moisture expansion	m/m/kg/kg	0.33	0	0.33
Axial tensile strength	MPa	72	276	54
Axial compressive strength	MPa	102	276	108
Transverse tensile strength	MPa	72	276	54
Transverse compressive strength	MPa	102	276	108
Shear strength	MPa	34	138	54
Specific gravity		1.2	2.7	1.2

Source: Tsai, S.W and Hahn, H.T., Introduction to Composite Materials, CRC Press