Registration no: | | | | | | | | | 5 | 3 |

Total Number of Pages: 02

M.TECH
MDPE209

Second Semester Examination 2013
EXPERIMENTAL STRESS ANALYSIS

Time: 3 Hours
Max marks: 70

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: (2 x 10)

a) How would you obtain stresses from Airy's stress function?
b) Define strain sensitivity of a gauge.
c) What is the necessity of temperature compensation ?
d) Define a strain rosette.
e) What is a dummy gauge ?
f) Define piezoelectric effect.
g) What is photo elastic effect ?
h) What is the direction of cracks when the coatings fail ?
i) What is the apparent stress ?
j) What is a photo grid ?

Q2 a) The state of stress at a point of interest in a solid body is defined as (5)

$$[\tau_{ij}] = \begin{bmatrix} 30 & 50 & 60 \\ 50 & 20 & 0 \\ 60 & 0 & 10 \end{bmatrix} N/mm^2$$

Determine the principal stresses and their directions.

b) The state of strain at a point of interest in a solid body is defined as (5)

$$[\varepsilon_{ij}] = \begin{bmatrix} 2.74 & -2.12 & 4.07 \\ -2.12 & -3.69 & -3.02 \\ 4.07 & -3.02 & 5.05 \end{bmatrix} \times 10^4$$

Determine the principal strains and their directions.

Q3 a) What are the basic characteristics of a strain gauge ? Which factors should be considered while selecting a strain gauge ? (5)

b) What are the various types of strain gauges ? Give their special advantages and limitations. (5)

Q4 a) A rectangular rosette is mounted on steel (E=200GPa, ν = 0.285). The gauge factors given by the manufacturer are F=2.09, K=0.02. The gauge readings taken are Q_a= 750 $\mu m/m$, Q_b= 1000 $\mu m/m$ and Q_c= -200 $\mu m/m$. Determine the principal stresses in magnitude and directions. (5)

b) Describe the piezoelectric effect. How piezoelectric gauges compare with piezoresistive gauges ? (5)

Q5 a) Discuss the various methods for calibrating a strain gauge. (5)

b) In a resistance type bridge circuit the resistances are R_1=9800Ω, R_2=8800Ω, R_3=8500Ω and R_4=9000Ω. If the bridge is of voltage sensitive type and the input voltages is 12 V, then what should be the meter reading ? (5)

Q6 a) State the stress optic law and obtain an expression for the same. (5)
b) Describe the basic elements of a polariscope. (5)

Q7 a) Explain the brittle coating method in brief. What are the advantages and limitation of this method ? (5)

b) Explain the grid method of strain analysis in brief. What are the advantages and limitation of this method ? (5)

Q8 Write short notes on any two (5x 2)

a) The core method
b) Multilayer reflection technique.
c) Stress freezing method