Chapter 10

Summary

Different analytical and numerical methods have been employed to investigate the physical quantities like displacement, temperature, stress and strain etc. in the problem of generalized thermoelasticity and magneto-thermoelasticity. In some cases Laplace transform and Fourier transform techniques have been used, and in some problems only Laplace transform has been used. Some problems have been solved applying state-space approach developed by Bahar and Hetnarski\[15, 16, 17\] and one problem has been solved using Galerkin finite element technique. In some problems governing equations are taken in Laplace-Fourier transform domain. The solutions in Laplace transform domain are obtained by taking Fourier inversion, which is carried out by using residual calculus, where the poles of the integrand are obtained numerically in complex domain by using Laguerre’s method. To obtain the solution in space-time domain inversion has been carried out. To get the solution in time domain different numerical inversion methods have been used. In some problems method of Bellman et al. [27] has been used and in some other problems a numerical method based on Fourier series expansion[82] has been used.

- The presence of damping coefficient and magnetic field has significant effect on elastic and thermal wave speeds.
• There is no effect of finite thermal wave speed and wave frequency on modified 
elastic wave speed in the presence of damping coefficient, but this is not so for the 
modified thermal wave speed.

• Magnitude of displacement decreases with the increase of magnetic field.

• Magnetic field has no effect on temperature field even for the case of two-temperature 
generalized thermoelasticity and this is due to the fact that the two fields (magnetic 
and temperature) are independent of each other but for the case of functionally 
graded material, magnetic field has an effect on temperature field and the effect is 
such that with the increase of magnetic field, magnitude of temperature decreases.

• Magnetic field acts to increase the magnitudes of induced magnetic field and the 
induced electric field for two-temperature generalized thermoelasticity.

• Rates of decay of displacement and temperature become slow with the increase of 
value of the damping coefficient.

• Rates of decay of displacement, temperature and stress are slower in case of 3P 
model than that of GNIII model and that is again slower than that of GNII model 
for all the cases.

• In case of displacement and temperature, the time to reach steady state for GNII 
model is faster than that of other two models (GNIII and 3P model) in presence of 
magnetic field as well as in absence of magnetic field and this fact is quite plausible 
since for GNII model, there is no dissipation of energy.

• It is observed that for GNII model, stress has discontinuity at some points for 
one-temperature theory whereas for two-temperature theory, it is continuous but 
for other two models of generalized thermoelasticity (GNIII and 3P model), stress 
has no discontinuity for one-temperature as well as two-temperature theory.
• It can be observed that rates of decay for both types of temperature (conductive and thermodynamic) are slower in case of two-temperature theory than in the case of one-temperature theory in presence of magnetic field and also in absence of magnetic field.

• For transversely isotropic material, magnitude of radial stress is large in presence of magnetic field than in absence of magnetic field for GNIII and 3P model.

• The magnitudes of radial stress and temperature are large for transversely isotropic material in comparison with isotropic material but the magnitude of hoop stress is reversed in nature.

• Radial stress is oscillatory in nature at the beginning for both the models (GNIII and 3P model) but the nature vanishes rapidly for 3P model than for GNIII model.

• Magnitude of displacement is small for rotating medium than in the case of non-rotating medium.

• For rotating medium, the displacement shows oscillatory nature with decreasing amplitude with respect to time and the stress shows oscillatory nature after a certain time, which also vanishes with time. For non-rotating medium, displacement and stress can never be oscillatory.

• For stress distribution, the time to reach the steady state increases with magnetic field in case of two-temperature three-phase-lag theory (2T3P).

• For 2T3P model of magneto-thermoelasticity, strain and induced magnetic field show oscillatory nature first but this nature vanishes with distance.