LIST OF SYMBOLS AND NOMENCLATURES

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>a</td>
<td>Deceleration rate m/Sec^2</td>
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<tr>
<td>A</td>
<td>Thermal diffusivity, m^2/h</td>
</tr>
<tr>
<td>A_{pad}</td>
<td>Brake pad Area m^2</td>
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<tr>
<td>A_{rotor}</td>
<td>Rotor swept area m^2</td>
</tr>
<tr>
<td>A_{mc}</td>
<td>Area of the master cylinder m^2</td>
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<tr>
<td>A_{c}</td>
<td>Area of the cooling surface m^2</td>
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<tr>
<td>A_{rotor}</td>
<td>Area of the rotor m^2</td>
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<tr>
<td>A_{pad}</td>
<td>Area of the pad in m^2</td>
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<tr>
<td>A_{bc}</td>
<td>Area of the backing plate in m^2</td>
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<tr>
<td>A_{bb}</td>
<td>Area of the thermal backing in m^2</td>
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<tr>
<td>A_{cali}</td>
<td>Area of the caliper in m^2</td>
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<tr>
<td>A_{t}</td>
<td>Total rotor convective area in transverse side m^2</td>
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<tr>
<td>b</td>
<td>Cooling coefficient</td>
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<tr>
<td>C_{ac}</td>
<td>Aero dynamic coefficient</td>
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<tr>
<td>c_{r}</td>
<td>Specific heat of Rotor material J/gm-K</td>
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<tr>
<td>c_{p}</td>
<td>Specific heat of Pad material J/gm-K</td>
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<td>D</td>
<td>Diameter of the rotor in mm</td>
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<td>E_{b}</td>
<td>Braking energy Nm</td>
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<td>F_{s}</td>
<td>Driver's effort N</td>
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<tr>
<td>f_{r}</td>
<td>Rolling resistance N</td>
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<td>g</td>
<td>Acceleration due to gravity m/Sec^2</td>
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<tr>
<td>h</td>
<td>Average heat transfer coefficient W/m^2-K</td>
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<tr>
<td>h_{pad}</td>
<td>heat transfer coefficient of the pad W/m^2-K</td>
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</table>
\( h_{bc} \) = heat transfer coefficient of the backing plate \( \text{W/m}^2\text{-K} \)

\( h_{ab} \) = heat transfer coefficient of the thermal backing \( \text{W/m}^2\text{-K} \)

\( h_{cali} \) = heat transfer coefficient of the caliper \( \text{W/m}^2\text{-K} \)

\( h_{con} \) = Conductive heat transfer coefficient \( \text{W/m}^2\text{-K} \)

\( h_{conv} \) = Convective heat transfer coefficient of rotor \( \text{W/m}^2\text{-K} \)

\( h_{rad} \) = Radiative heat transfer coefficient \( \text{W/m}^2\text{-K} \)

\( h_{eq} \) = Effective overall heat transfer coefficient \( \text{W/m}^2\text{-K} \)

\( h_p \) = Convective heat transfer coefficient of pad \( \text{W/m}^2\text{-K} \)

\( I \) = Mass moment of inertia of the rotating mass \( \text{kg m}^2 \)

\( k_a \) = Conductivity of air \( \text{W/m - K} \)

\( k_r \) = Conductivity of rotor material \( \text{W/m - K} \)

\( k_s \) = Thermal conductivity of pad support \( \text{W/m - K} \)

\( k_{pad} \) = Conductivity of pad material \( \text{W/m - K} \)

\( k_{bc} \) = Conductivity of backing plate material \( \text{W/m - K} \)

\( k_{rotor} \) = Thermal conductivity of the rotor \( \text{W/m - K} \)

\( k \) = Ratio of outer radius to inner radius

\( L \) = one half rotor thickness, m

\( L_{eq} \) = Equivalent rotor half width m

\( l_p \) = Brake lever ratio

\( m \) = Mass of vehicle Kg

\( N_a \) = Nusselt Number

\( N \) = Speed of the disc rotor rpm

\( p \) = Line pressure kPa

\( q_R \) = Heat flux in to pad \( \text{N-m/h-m}^2 \)

\( q_P \) = Heat flux in to rotor \( \text{N-m/h-m}^2 \)

\( q'_{(0)} \) = Heat flux into rotor surface immediately after braking \( \text{N - m/h - m}^2 \)
 Heat transfer due to conduction kJ
 Heat transfer due to convection kJ
 Heat transfer due to radiation kJ
 Rolling radius mm
 Outer radius of rotor m
 Inner radius of rotor m
 Rolling radius of the vehicle in m
 Thermal resistance to conductive heat flow in pad h-K/N-m
 Thermal resistance to conductive heat flow in rotor h-K/N-m
 Reynolds Number
 Cooling passage Reynolds Number
 Stopping distance of vehicle m
 Braking cycle time Sec
 Stop times Sec
 Torque transmitted during braking N-m
 Maximum Temperature °C
 Initial Temperature °C
 Transient temperature distribution in rotor due to a constant heat flux, K
 Initial temperature, K
 Final temperature of the disc
 Ambient temperature K
 Relative temperature response resulting from time-varying heat flux, K
 Kinetic energy or energy absorbed J
 Vehicle velocity m/Sec
 Initial velocity of vehicle m/Sec
\( V_2 \) = Velocity at the end of braking m/Sec
\( W \) = Vehicle weight N
\( W_a \) = Front axle weight N
\( W_{\text{rotor}} \) = width of the rotor in m
\( W_{\text{pad}} \) = width of the pad in m
\( W_{\text{bc}} \) = width of the backing plate in m
\( W_{\text{tbh}} \) = width of the thermal backing in m
\( W_{\text{cali}} \) = width of the caliper in m
\( \theta \) = Angle of pad Deg.
\( \theta_0(z,t) \) = Relative temperature of brake resulting from constant heat flux, K
\( \theta_i \) = Initial temperature difference between brake and ambience, K
\( \mu \) = Friction coefficient
\( \varepsilon_R \) = Rotor surface emissivity
\( \sigma \) = Stefan-Boltzmann constant \( 5.67 \times 10^{-8} \) J/gm²/s
\( \nu \) = Kinematic viscosity m²/s
\( \gamma \) = Heat distribution factor
\( \gamma_b \) = Braking factor
\( \omega_r \) = Angular velocity of the rotor 1/s
\( \omega_1 \) = Angular velocity of rotating pads at begin in braking 1/s
\( \omega_2 \) = Angular velocity of rotating pads at end in braking 1/s
\( \rho_r \) = Density of rotor material Kg/m³
\( \rho_p \) = Density of pad material Kg/m³
\( \delta_{\text{pad}} \) = Pad thickness m
\[ \delta_{abc} = \text{Pad backing plate thickness m} \]
\[ \eta = \text{Braking efficiency of vehicle \%} \]
\[ \eta_b = \text{Brake lever efficiency \%} \]