Q.P. Code : 856203

( 3 Hours ) [Total Marks : 80]

N.B: 1. Solve any **FOUR** questions.
2. Assume suitable data if necessary and mention it clearly.
3. Draw sketches wherever required.
4. Use Annexure 1 and 2 for properties of water and air respectively.

1 (a) Define Grashof number? Physically what does Grashof number represents? How does Grashof number differ from Reynold's number? **5**

(b) A 12-cm-wide and 18-cm-high vertical hot surface in 30°C air is to be cooled by a heat sink with equally spaced fins of rectangular profile (Fig. 9–20). The fins are 0.1 cm thick and 18 cm long in the vertical direction and have a height of 2.4 cm from the base. Determine the optimum fin spacing and the rate of heat transfer by natural convection from the heat sink if the base temperature is 80°C. **10**

(c) Explain natural convection inside enclosures. **5**

2 (a) 30 m long, 10 cm diameter hot water pipe of a district heating system is buried in the soil 50 cm below the ground surface. The outer surface temperature of the pipe is 80°C. Taking the surface temperature of the earth to be 10°C and the thermal conductivity of the soil at that location to be 0.9 W/m · °C, determine the rate of heat loss from the pipe. Take k= 0.9 W/m K. **5**

(b) An ordinary egg can be approximated as a 5 cm diameter sphere. The egg is initially at a uniform temperature of 5°C and is dropped into boiling water at 95°C. Taking the convection heat transfer coefficient to be $h$ =1200 W/m²K, determine how long it will take for the center of the egg to reach 70°C. Take $\lambda_1$=3.0754 $A_1$=1.9958 **5**

(c) What is conduction shape factor and how it is related to thermal resistance? **5**

(d) What do you mean by heat transfer in common configuration? Define conduction shape factor? **5**

3 (a) The thermal contact conductance at the interface of two 1-cm-thick aluminum plates is measured to be 11,000 W/m² °C. Determine the thickness of the aluminum plate whose thermal resistance is equal to the thermal resistance of the interface between the plates. **5**

(b) How active and passive heat transfer enhancement techniques differ? **5**

(c) Explain how the thermal contact resistance can be minimized? **5**

(d) Consider a 2m high and 0.7m wide bronze plate whose thickness is 0.1 m. One side of the plate is maintained at a constant temperature of 600 K while the other side is maintained at 400 K. The thermal conductivity of the bronze plate can be assumed to vary linearly in that temperature range as $k(T) = k_0(1+\beta T)$ where $k_0$ = 38 W/mK and $\beta$= 9.21×10$^{-4}$ K$^{-1}$. Disregarding the edge effects and assuming steady one-dimensional heat transfer, determine the rate of heat conduction through the plate. **5**

**TURN OVER**

4 (a) Water entering at 10 °C is to be heated to 40°C in a tube of 0.02 m inner diameter 12
at a mass flow rate of 0.01 kg/s. The outside of the tube is wrapped with an
insulated electric heating element that produces a uniform flux of 15 kW/m² over
the surface. Neglect entrance effect. Determine: (i) Reynolds number (ii) Heat
transfer coefficient (iii) Length of pipe needed for a 30°C increase in average
temperature (iv) Inner tube surface temperature at outlet (iv) Friction factor
(v) Pressure drop in pipe. Pumping power required if pump is 50% efficient.

(b) How heat transfer coefficient is enhanced in coiled tube? Define Dean Number. 4

(c) Write the applications of laminar flow forced convection heat transfer. 4

5 (a) The condenser of a steam power plant operates at a pressure of 7.38 kPa. Steam at 10
this pressure condenses on the outer surfaces of horizontal pipes through which
cooling water circulates. The outer diameter of the pipes is 3 cm, and the outer
surfaces of the pipes are maintained at 30°C. Determine (i) the rate of heat transfer
to the cooling water circulating in the pipes and (ii) the rate of condensation of
steam per unit length of a horizontal pipe. Use the properties of water in liquid and
vapor state as per the Annexure – 1.

(b) How does radiation transfer through a participating medium differ from that 5
through a nonparticipating medium?

(c) In condensate flow how wetted perimeter is defined? How it differs from ordinary 5
perimeter?

6 (a) Consider a large uranium plate of thickness 4 cm and thermal conductivity 10
28 W/m°C in which heat is generated uniformly at a constant rate of $5 \times 10^6$ W/m³.
One side of the plate is maintained at 0°C by iced water while the other side is
subjected to convection to an environment at 30°C with a heat transfer coefficient
of 45 W/m²°C. Considering a total of three equally spaced nodes in the medium,
two at the boundaries and one at the middle, estimate the exposed surface
temperature of the plate under steady conditions using the finite difference
approach.

(b) Define these terms used in the finite difference formulation: node, nodal network, 5
volume element, nodal spacing, and difference equation.

(c) What are advantages and disadvantages of numerical and analytical methods? 5

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## ANNEXURE – 1

## Properties of water

| Temp. $T$, °C | Saturation Pressure $P_{sat}$, kPa | Density $\rho$, kg/m³ | | Enthalpy of Vaporization $h_{fg}$, kJ/kg | Specific Heat $c_p$, J/kg·K | | Thermal Conductivity $k$, W/m·K | | Dynamic Viscosity $\mu$, kg/m·s | | Prandtl Number Pr | | Volume Expansion Coefficient $\beta$, 1/K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Liquid | Vapor | | Liquid | Vapor | Liquid | Vapor | Liquid | Vapor | Liquid | Vapor | Liquid |
| 0.01 | 0.6113 | 999.8 | 0.0048 | 2501 | 4217 | 1854 | 0.561 | 0.0171 | $1.792 \times 10^{-3}$ | $0.922 \times 10^{-5}$ | 13.5 | 1.00 | $-0.068 \times 10^{-3}$ |
| 5 | 0.8721 | 999.9 | 0.0068 | 2490 | 4205 | 1857 | 0.571 | 0.0173 | $1.519 \times 10^{-3}$ | $0.934 \times 10^{-5}$ | 11.2 | 1.00 | $0.015 \times 10^{-3}$ |
| 10 | 1.2276 | 999.7 | 0.0094 | 2478 | 4194 | 1862 | 0.580 | 0.0176 | $1.307 \times 10^{-3}$ | $0.946 \times 10^{-5}$ | 9.45 | 1.00 | $0.733 \times 10^{-3}$ |
| 15 | 1.7051 | 999.1 | 0.0128 | 2466 | 4185 | 1863 | 0.589 | 0.0179 | $1.138 \times 10^{-3}$ | $0.959 \times 10^{-5}$ | 8.09 | 1.00 | $0.138 \times 10^{-3}$ |
| 20 | 2.339 | 998.0 | 0.0173 | 2454 | 4182 | 1867 | 0.598 | 0.0182 | $1.002 \times 10^{-3}$ | $0.973 \times 10^{-5}$ | 7.01 | 1.00 | $0.195 \times 10^{-3}$ |
| 25 | 3.169 | 997.0 | 0.0231 | 2442 | 4180 | 1870 | 0.607 | 0.0186 | $0.891 \times 10^{-3}$ | $0.987 \times 10^{-5}$ | 6.14 | 1.00 | $0.247 \times 10^{-3}$ |
| 30 | 4.246 | 996.0 | 0.0304 | 2431 | 4178 | 1875 | 0.615 | 0.0189 | $0.798 \times 10^{-3}$ | $1.001 \times 10^{-5}$ | 5.42 | 1.00 | $0.294 \times 10^{-3}$ |
| 35 | 5.628 | 994.0 | 0.0397 | 2419 | 4178 | 1880 | 0.623 | 0.0192 | $0.720 \times 10^{-3}$ | $1.016 \times 10^{-5}$ | 4.83 | 1.00 | $0.337 \times 10^{-3}$ |
| 40 | 7.384 | 992.1 | 0.0512 | 2407 | 4179 | 1885 | 0.631 | 0.0196 | $0.653 \times 10^{-3}$ | $1.031 \times 10^{-5}$ | 4.32 | 1.00 | $0.377 \times 10^{-3}$ |
| 45 | 9.593 | 990.1 | 0.0655 | 2395 | 4180 | 1892 | 0.637 | 0.0200 | $0.596 \times 10^{-3}$ | $1.046 \times 10^{-5}$ | 3.91 | 1.00 | $0.415 \times 10^{-3}$ |
| 50 | 12.35 | 988.1 | 0.0831 | 2383 | 4181 | 1900 | 0.644 | 0.0204 | $0.547 \times 10^{-3}$ | $1.062 \times 10^{-5}$ | 3.55 | 1.00 | $0.451 \times 10^{-3}$ |
| 55 | 15.76 | 985.2 | 0.1045 | 2371 | 4183 | 1908 | 0.649 | 0.0208 | $0.504 \times 10^{-3}$ | $1.077 \times 10^{-5}$ | 3.25 | 1.00 | $0.484 \times 10^{-3}$ |
| 60 | 19.94 | 983.3 | 0.1304 | 2359 | 4185 | 1916 | 0.654 | 0.0212 | $0.467 \times 10^{-3}$ | $1.093 \times 10^{-5}$ | 2.99 | 1.00 | $0.517 \times 10^{-3}$ |
| 65 | 25.03 | 980.4 | 0.1614 | 2346 | 4187 | 1926 | 0.659 | 0.0216 | $0.433 \times 10^{-3}$ | $1.110 \times 10^{-5}$ | 2.75 | 1.00 | $0.548 \times 10^{-3}$ |
| 70 | 31.19 | 977.5 | 0.1983 | 2334 | 4190 | 1936 | 0.663 | 0.0221 | $0.404 \times 10^{-3}$ | $1.126 \times 10^{-5}$ | 2.55 | 1.00 | $0.578 \times 10^{-3}$ |
| 75 | 38.58 | 974.7 | 0.2421 | 2321 | 4193 | 1948 | 0.667 | 0.0225 | $0.378 \times 10^{-3}$ | $1.142 \times 10^{-5}$ | 2.38 | 1.00 | $0.607 \times 10^{-3}$ |
| 80 | 47.39 | 971.8 | 0.2935 | 2309 | 4197 | 1962 | 0.670 | 0.0230 | $0.355 \times 10^{-3}$ | $1.159 \times 10^{-5}$ | 2.22 | 1.00 | $0.653 \times 10^{-3}$ |
| 85 | 57.83 | 968.1 | 0.3536 | 2296 | 4201 | 1977 | 0.673 | 0.0235 | $0.333 \times 10^{-3}$ | $1.176 \times 10^{-5}$ | 2.08 | 1.00 | $0.670 \times 10^{-3}$ |
| 90 | 70.14 | 965.3 | 0.4235 | 2283 | 4206 | 1993 | 0.675 | 0.0240 | $0.315 \times 10^{-3}$ | $1.193 \times 10^{-5}$ | 1.96 | 1.00 | $0.702 \times 10^{-3}$ |
| 95 | 84.55 | 961.5 | 0.5045 | 2270 | 4212 | 2010 | 0.677 | 0.0246 | $0.297 \times 10^{-3}$ | $1.210 \times 10^{-5}$ | 1.85 | 1.00 | $0.716 \times 10^{-3}$ |
| 100 | 101.33 | 957.9 | 0.5978 | 2257 | 4217 | 2029 | 0.679 | 0.0251 | $0.282 \times 10^{-3}$ | $1.227 \times 10^{-5}$ | 1.75 | 1.00 | $0.750 \times 10^{-3}$ |
| 110 | 143.27 | 950.6 | 0.8263 | 2230 | 4229 | 2071 | 0.682 | 0.0262 | $0.255 \times 10^{-3}$ | $1.261 \times 10^{-5}$ | 1.58 | 1.00 | $0.798 \times 10^{-3}$ |
| 120 | 198.53 | 943.4 | 1.121 | 2203 | 4244 | 2120 | 0.683 | 0.0275 | $0.232 \times 10^{-3}$ | $1.296 \times 10^{-5}$ | 1.44 | 1.00 | $0.858 \times 10^{-3}$ |
| 130 | 270.1 | 934.6 | 1.496 | 2174 | 4263 | 2177 | 0.684 | 0.0288 | $0.213 \times 10^{-3}$ | $1.330 \times 10^{-5}$ | 1.33 | 1.01 | $0.913 \times 10^{-3}$ |
| 140 | 361.3 | 921.7 | 1.965 | 2145 | 4286 | 2244 | 0.683 | 0.0301 | $0.197 \times 10^{-3}$ | $1.365 \times 10^{-5}$ | 1.24 | 1.02 | $0.970 \times 10^{-3}$ |
| 150 | 475.8 | 916.6 | 2.546 | 2114 | 4311 | 2314 | 0.682 | 0.0316 | $0.183 \times 10^{-3}$ | $1.399 \times 10^{-5}$ | 1.16 | 1.02 | $1.025 \times 10^{-3}$ |
| 160 | 617.8 | 907.4 | 3.256 | 2083 | 4340 | 2420 | 0.680 | 0.0331 | $0.170 \times 10^{-3}$ | $1.434 \times 10^{-5}$ | 1.09 | 1.05 | $1.145 \times 10^{-3}$ |
| 170 | 791.7 | 897.7 | 4.119 | 2050 | 4370 | 2490 | 0.677 | 0.0347 | $0.160 \times 10^{-3}$ | $1.468 \times 10^{-5}$ | 1.03 | 1.05 | $1.178 \times 10^{-3}$ |
| 180 | 1,002.1 | 887.3 | 5.153 | 2015 | 4410 | 2590 | 0.673 | 0.0364 | $0.150 \times 10^{-3}$ | $1.502 \times 10^{-5}$ | 0.983 | 1.07 | $1.210 \times 10^{-3}$ |
| 190 | 1,254.4 | 876.4 | 6.388 | 1979 | 4460 | 2710 | 0.669 | 0.0382 | $0.142 \times 10^{-3}$ | $1.537 \times 10^{-5}$ | 0.947 | 1.09 | $1.280 \times 10^{-3}$ |
| 200 | 1,553.8 | 864.3 | 7.852 | 1941 | 4500 | 2840 | 0.663 | 0.0401 | $0.134 \times 10^{-3}$ | $1.571 \times 10^{-5}$ | 0.910 | 1.11 | $1.350 \times 10^{-3}$ |
| 220 | 2,318 | 840.3 | 11.60 | 1859 | 4610 | 3110 | 0.650 | 0.0442 | $0.122 \times 10^{-3}$ | $1.641 \times 10^{-5}$ | 0.865 | 1.15 | $1.520 \times 10^{-3}$ |
| 240 | 3,344 | 813.7 | 16.73 | 1767 | 4760 | 3520 | 0.632 | 0.0487 | $0.111 \times 10^{-3}$ | $1.712 \times 10^{-5}$ | 0.836 | 1.24 | $1.720 \times 10^{-3}$ |
| 260 | 4,688 | 783.7 | 23.69 | 1663 | 4970 | 4070 | 0.609 | 0.0540 | $0.102 \times 10^{-3}$ | $1.788 \times 10^{-5}$ | 0.832 | 1.35 | $2.000 \times 10^{-3}$ |
| 280 | 6,412 | 750.8 | 33.15 | 1544 | 5280 | 4835 | 0.581 | 0.0605 | $0.094 \times 10^{-3}$ | $1.870 \times 10^{-5}$ | 0.854 | 1.49 | $2.380 \times 10^{-3}$ |
| 300 | 8,581 | 713.8 | 46.15 | 1405 | 5750 | 5980 | 0.548 | 0.0695 | $0.086 \times 10^{-3}$ | $1.965 \times 10^{-5}$ | 0.902 | 1.69 | $2.950 \times 10^{-3}$ |
| 320 | 11,274 | 667.1 | 64.57 | 1239 | 6540 | 7900 | 0.509 | 0.0836 | $0.078 \times 10^{-3}$ | $2.084 \times 10^{-5}$ | 1.00 | 1.97 | |
| 340 | 14,586 | 610.5 | 92.62 | 1028 | 8240 | 11,870 | 0.469 | 0.110 | $0.070 \times 10^{-3}$ | $2.255 \times 10^{-5}$ | 1.23 | 2.43 | |
| 360 | 18,651 | 528.3 | 144.0 | 720 | 14,690 | 25,800 | 0.427 | 0.178 | $0.060 \times 10^{-3}$ | $2.571 \times 10^{-5}$ | 2.06 | 3.73 | |
| 374.14 | 22,090 | 317.0 | 317.0 | 0 | — | — | — | — | $0.043 \times 10^{-3}$ | $4.313 \times 10^{-5}$ | | | |

**TURN OVER**

## ANNEXURE – 2

### Properties of Air

| Temp. $T$, °C | Density $\rho$, kg/m³ | Specific Heat $c_p$, J/kg·K | Thermal Conductivity $k$, W/m·K | Thermal Diffusivity $\alpha$, m²/s | Dynamic Viscosity $\mu$, kg/m·s | Kinematic Viscosity $\nu$, m²/s | Prandtl Number Pr |
|---|---|---|---|---|---|---|---|
| −150 | 2.866 | 983 | 0.01171 | $4.158 \times 10^{-6}$ | $8.636 \times 10^{-6}$ | $3.013 \times 10^{-6}$ | 0.7246 |
| −100 | 2.038 | 966 | 0.01582 | $8.036 \times 10^{-6}$ | $1.189 \times 10^{-5}$ | $5.837 \times 10^{-6}$ | 0.7263 |
| −50 | 1.582 | 999 | 0.01979 | $1.252 \times 10^{-5}$ | $1.474 \times 10^{-5}$ | $9.319 \times 10^{-6}$ | 0.7440 |
| −40 | 1.514 | 1002 | 0.02057 | $1.356 \times 10^{-5}$ | $1.527 \times 10^{-5}$ | $1.008 \times 10^{-5}$ | 0.7436 |
| −30 | 1.451 | 1004 | 0.02134 | $1.465 \times 10^{-5}$ | $1.579 \times 10^{-5}$ | $1.087 \times 10^{-5}$ | 0.7425 |
| −20 | 1.394 | 1005 | 0.02211 | $1.578 \times 10^{-5}$ | $1.630 \times 10^{-5}$ | $1.169 \times 10^{-5}$ | 0.7408 |
| −10 | 1.341 | 1006 | 0.02288 | $1.696 \times 10^{-5}$ | $1.680 \times 10^{-5}$ | $1.252 \times 10^{-5}$ | 0.7387 |
| 0 | 1.292 | 1006 | 0.02364 | $1.818 \times 10^{-5}$ | $1.729 \times 10^{-5}$ | $1.338 \times 10^{-5}$ | 0.7362 |
| 5 | 1.269 | 1006 | 0.02401 | $1.880 \times 10^{-5}$ | $1.754 \times 10^{-5}$ | $1.382 \times 10^{-5}$ | 0.7350 |
| 10 | 1.246 | 1006 | 0.02439 | $1.944 \times 10^{-5}$ | $1.778 \times 10^{-5}$ | $1.426 \times 10^{-5}$ | 0.7336 |
| 15 | 1.225 | 1007 | 0.02476 | $2.009 \times 10^{-5}$ | $1.802 \times 10^{-5}$ | $1.470 \times 10^{-5}$ | 0.7323 |
| 20 | 1.204 | 1007 | 0.02514 | $2.074 \times 10^{-5}$ | $1.825 \times 10^{-5}$ | $1.516 \times 10^{-5}$ | 0.7309 |
| 25 | 1.184 | 1007 | 0.02551 | $2.141 \times 10^{-5}$ | $1.849 \times 10^{-5}$ | $1.562 \times 10^{-5}$ | 0.7296 |
| 30 | 1.164 | 1007 | 0.02588 | $2.208 \times 10^{-5}$ | $1.872 \times 10^{-5}$ | $1.608 \times 10^{-5}$ | 0.7282 |
| 35 | 1.145 | 1007 | 0.02625 | $2.277 \times 10^{-5}$ | $1.895 \times 10^{-5}$ | $1.655 \times 10^{-5}$ | 0.7268 |
| 40 | 1.127 | 1007 | 0.02662 | $2.346 \times 10^{-5}$ | $1.918 \times 10^{-5}$ | $1.702 \times 10^{-5}$ | 0.7255 |
| 45 | 1.109 | 1007 | 0.02699 | $2.416 \times 10^{-5}$ | $1.941 \times 10^{-5}$ | $1.750 \times 10^{-5}$ | 0.7241 |
| 50 | 1.092 | 1007 | 0.02735 | $2.487 \times 10^{-5}$ | $1.963 \times 10^{-5}$ | $1.798 \times 10^{-5}$ | 0.7228 |
| 60 | 1.059 | 1007 | 0.02808 | $2.632 \times 10^{-5}$ | $2.008 \times 10^{-5}$ | $1.896 \times 10^{-5}$ | 0.7202 |
| 70 | 1.028 | 1007 | 0.02881 | $2.780 \times 10^{-5}$ | $2.052 \times 10^{-5}$ | $1.995 \times 10^{-5}$ | 0.7177 |
| 80 | 0.9994 | 1008 | 0.02953 | $2.931 \times 10^{-5}$ | $2.096 \times 10^{-5}$ | $2.097 \times 10^{-5}$ | 0.7154 |
| 90 | 0.9718 | 1008 | 0.03024 | $3.085 \times 10^{-5}$ | $2.139 \times 10^{-5}$ | $2.201 \times 10^{-5}$ | 0.7132 |
| 100 | 0.9458 | 1009 | 0.03095 | $3.243 \times 10^{-5}$ | $2.181 \times 10^{-5}$ | $2.306 \times 10^{-5}$ | 0.7111 |
| 120 | 0.8977 | 1011 | 0.03235 | $3.565 \times 10^{-5}$ | $2.264 \times 10^{-5}$ | $2.522 \times 10^{-5}$ | 0.7073 |
| 140 | 0.8542 | 1013 | 0.03374 | $3.898 \times 10^{-5}$ | $2.345 \times 10^{-5}$ | $2.745 \times 10^{-5}$ | 0.7041 |
| 160 | 0.8148 | 1016 | 0.03511 | $4.241 \times 10^{-5}$ | $2.420 \times 10^{-5}$ | $2.975 \times 10^{-5}$ | 0.7014 |
| 180 | 0.7788 | 1019 | 0.03646 | $4.593 \times 10^{-5}$ | $2.504 \times 10^{-5}$ | $3.212 \times 10^{-5}$ | 0.6992 |
| 200 | 0.7459 | 1023 | 0.03779 | $4.954 \times 10^{-5}$ | $2.577 \times 10^{-5}$ | $3.455 \times 10^{-5}$ | 0.6974 |
| 250 | 0.6746 | 1033 | 0.04104 | $5.890 \times 10^{-5}$ | $2.760 \times 10^{-5}$ | $4.091 \times 10^{-5}$ | 0.6946 |
| 300 | 0.6158 | 1044 | 0.04418 | $6.871 \times 10^{-5}$ | $2.934 \times 10^{-5}$ | $4.765 \times 10^{-5}$ | 0.6935 |
| 350 | 0.5664 | 1056 | 0.04721 | $7.892 \times 10^{-5}$ | $3.101 \times 10^{-5}$ | $5.475 \times 10^{-5}$ | 0.6937 |
| 400 | 0.5243 | 1069 | 0.05015 | $8.951 \times 10^{-5}$ | $3.261 \times 10^{-5}$ | $6.219 \times 10^{-5}$ | 0.6948 |
| 450 | 0.4880 | 1081 | 0.05298 | $1.004 \times 10^{-4}$ | $3.415 \times 10^{-5}$ | $6.997 \times 10^{-5}$ | 0.6965 |
| 500 | 0.4565 | 1093 | 0.05572 | $1.117 \times 10^{-4}$ | $3.563 \times 10^{-5}$ | $7.806 \times 10^{-5}$ | 0.6986 |
| 600 | 0.4042 | 1115 | 0.06093 | $1.352 \times 10^{-4}$ | $3.846 \times 10^{-5}$ | $9.515 \times 10^{-5}$ | 0.7037 |
| 700 | 0.3627 | 1135 | 0.06581 | $1.598 \times 10^{-4}$ | $4.111 \times 10^{-5}$ | $1.133 \times 10^{-4}$ | 0.7092 |
| 800 | 0.3289 | 1153 | 0.07037 | $1.855 \times 10^{-4}$ | $4.362 \times 10^{-5}$ | $1.326 \times 10^{-4}$ | 0.7149 |
| 900 | 0.3008 | 1169 | 0.07465 | $2.122 \times 10^{-4}$ | $4.600 \times 10^{-5}$ | $1.529 \times 10^{-4}$ | 0.7206 |
| 1000 | 0.2772 | 1184 | 0.07868 | $2.398 \times 10^{-4}$ | $4.826 \times 10^{-5}$ | $1.741 \times 10^{-4}$ | 0.7260 |
| 1500 | 0.1990 | 1234 | 0.09599 | $3.908 \times 10^{-4}$ | $5.817 \times 10^{-5}$ | $2.922 \times 10^{-4}$ | 0.7478 |
| 2000 | 0.1553 | 1264 | 0.11113 | $5.664 \times 10^{-4}$ | $6.630 \times 10^{-5}$ | $4.270 \times 10^{-4}$ | 0.7539 |