BIRLA INSTITUTE OF TECHNOLOGY
MESRA – 835215, RANCHI, INDIA

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Name: ………………………………………………. Roll No.: ………………………………………..
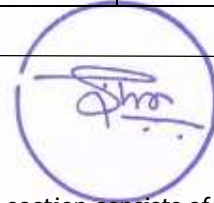
Branch: ………………………………………………. Signature of Invigilator: ……………………

Semester: IVth   Date: 29/04/2022 (MORNING)

Subject with Code: **BE209 FLUID MECHANICS AND HEAT TRANSFER**

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE

1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.

2. The booklet will be distributed to the candidates before 05 minutes of the examination. **Candidates should write their roll no. in each page of the booklet.**

3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.

4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.

5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.

6. Write on both side of the leaf and use pens with same ink.

7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.

8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.

9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.

10. Always maintain the highest level of integrity. Remember you are a BITian.

11. Candidates need to **submit the question paper cum answer sheets before leaving the examination hall**.

| BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI				
(END SEMESTER EXAMINATION)				
CLASS:	B TECH			SEMESTER: IV
BRANCH:	Biotech			SESSION: SP/2022
SUBJECT: BE 209 Fluid mechanics and heat transfer				
TIME:	2 HOURS			FULL MARKS: 50

1. Stagnation point is the point in fluid mechanics where the velocity of the fluid at that point is a) unity b) constant c) infinite d) zero

2. Which among the following is an assumption of Hagen-Poiseuille equation? a) Fluid is uniform b) Fluid is laminar c) Fluid is turbulent d) Fluid is compressible

3. If the dynamic viscosity of a fluid is 0.5 poise and specific gravity is 0.5, then the kinematic viscosity of that fluid in stokes is a) 0.25 b) 0.50 c) 1.0 d) none of the above

4. Select the incorrect statement. a) The pressure intensity at vena contracta is atmospheric. b) Contraction is least at vena contracta. c) Stream lines are parallel throughout the jet at vena contracta. d) Coefficient of contraction is always less than one

5. Which of the following is an incorrect statement ? a) Coefficient of contraction of a venturimeter is unity. b) Flow nozzle is cheaper than venturimeter but has higher energy loss. c) Discharge is independent of orientation of venturimeter whether it is horizontal, vertical or inclined. d) None of the above statement is correct.

6. The major loss of energy in long pipes is due to a) sudden enlargement b) sudden contraction c) gradual contraction or enlargement d) friction

7. Which of the following statements is correct? a) Lower critical Reynolds number is of no practical significance in pipe flow problems. b) Upper critical Reynolds number is significant in pipe flow problems. c) Lower critical Reynolds number has the value 2000 in pipe flow d) Upper critical Reynolds number is the number at which turbulent flow changes to laminar flow.

8. For laminar flow in a pipe of circular cross-section the Darcy's friction factor f is a) directly proportional to Reynolds number and independent of pipe wall roughness b) directly proportional to pipe wall roughness and independent of Reynolds number c) inversely proportional to Reynolds number and independent of pipe wall roughness d) inversely proportional to Reynolds number and directly proportional to pipe wall roughness

9. The ratio of average velocity to maximum velocity for steady laminar flow in circular pipes is a) ½ b) 2/3 c) 3/2 d) 2

10. The velocity distribution for laminar flow through a circular tube a) is constant over the cross-section b) varies linearly from zero at walls to maximum at centre c) varies parabolically with maximum at the centre d) none of the above

11. Venturimeter is used to
a) Measure the velocity of a flowing liquid b) Measure the pressure of a flowing liquid
c) Measure the discharge of liquid flowing in a pipe d) Measure the pressure difference of liquid flowing between two points in a pipeline

12. A fluid which obeys the Newton's law of viscosity is termed as
a) Real fluid b) Ideal fluid c) Newtonian fluid d) Non-Newtonian fluid

13. A liquid flow with the same velocity through two pipes 1 and 2 having the same diameter. If the length of the second pipe be twice that of the first pipe, what should be the ratio of the head loss in the two pipes?
a) 1:2 b) 2:1 c) 1:4 d) 4:1

14. The ratio of the inertia force to the viscous force is called
a) Reynold's number b) Froude's number c) Weber's number d) Euler's number

15. Heat transfer in liquid and gases takes place by
a) Conduction b) Convection c) Radiation d) Conduction and convection

16. In convection heat transfer from hot flue gases to water tube, even though flow may be turbulent, a laminar flow region (boundary layer of film) exists close to the tube. The heat transfer through this film takes place by a) convection b) radiation c) conduction d) both convection and conduction

17. Emissivity of a white polished body in comparison to a blackbody is a) higher b) lower c) same d) depends upon the shape of body

18. A non-dimensional number generally associated with natural convection heat transfer is a) Grashoff number b) Nusselt number c) Weber number d) Prandtl number

19. The value of Prandtl number for air is about a) 0.1 b) 0.3 c) 0.7 d) 1.7

20. The value of the wavelength for maximum emissive power isgiven by a) Wien's law b) Planck's law c) Stefan's law d) Fourier's law

21. According to Stefan-Boltzmann law, ideal radiators emit radiant energy at a rate proportional to a) absolute temperature b) square of temperature c) fourth power of absolute temperature d) fourth power of temperature

22. In free con-vection heat transfer, Nusselt number is function of a) Grashoff no. and Reynold no. b) Grashoff no. and Prandtl no. c) Prandtl no. and Reynold no. d) Grashoff no., Prandtl no. and Reynold no.

23. Depending on the radiating properties, a body will be white when a) $p = 0$, $x = 0$ and $a = 1$ b) p=l,$T = 0$ and $a = 0$ c) $p = 0$, $x = 1$ and $a = 0$ d) $x = 0$, $a + p = 1$
where a = absorptivity, p = reflectivity, x = transmissivity

24. 40% of incident radiant energy on the surface of a thermally transparent body is reflected back. If the transmissivity of the body be 0.15, then the emissivity of surface is a) 0.45 b) 0.55 c) 0.40 d) 0.75

25. Two plates spaced 150 mm apart are maintained at 1000°C and70°C. The heat transfer will take place mainly by
a) convection b) free convection c) forced convection d) radiation

26. Which of the following has least value of conductivity a) glass b) water c) plastic d) air

27. Thermal diffusivity is a) a dimensionless parameter b) function of temperature c) used as mathematical model d) a physical property of the material

28. Fourier's law of heat conduction is valid for a) one dimensional cases only b) two dimensional cases only c) three dimensional cases only d) regular surfaces having non-uniform temperature gradients

29. Which of the following property of air does not increase with rise in temperature a) thermal conductivity b) thermal diffusivity c) density d) dynamic viscosity

30. The total emissivity power is defined as the total amount of radiation emitted by a black body per unit a) temperature b) thickness c) area d) time

Answer all the questions.

31. Water is flowing through a pipe of 1.5 km long with a velocity of 1.5 m/s. What should be the diameter of the pipe, if the loss of head due to friction is 10 m. Take coefficient of friction as f=0.01.   [2]

32. A pipe line tapers from 1.5 m in diameter at higher end to 1.0 m diameter at lower end in 400 m length at a slope of 1 in 100. The pressure at the higher end is 75 KPa. If the discharge is 60 m^3 /minute, find the pressure at lower end. Neglect losses.   [2]

33. A Venturimeter of 10 mm throat diameter is used to measure the velocity of water in a horizontal pipe of 20 mm diameter. If the pressure difference between the pipe and throat sections is found to be 30 kPa then, neglecting frictional losses, the flow velocity is?   [4]

34. A plane brick wall, 25 cm thick, is faced with 5 cm thick concrete layer. If the temperature of the exposed brick face is 70°C and that of the concrete is 25°C, find out the heat lost per hour through a wall of 15 m x10 m. Also, determine the interface temperature. Thermal conductivity of the brick and concrete are 0.7 W/m.K and 0.95 W/m.K respectively

70°C T_i 25°C
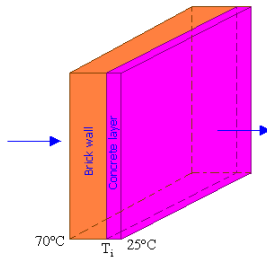
[4]

35. A thick walled tube of stainless steel (K = 19 W/m˚C) with 2 cm inner dia and 4 cm outer dia is covered with a 3 cm layer of asbestos insulation (K= 0.2 W/m˚C). Air at 600 ˚C flows through the pipe and the convective heat transfer coefficient from the air to the inside of the pipe has the value of h_i = 35 W/m² K . The outside surface of the pipe is surrounded by air which is at 100 ˚C and the convective coefficient for the outside is h_o= 10 W/ m² K. calculate the heat loss through 50 m of this pipe? [4]

36. Two parallel infinite gray surfaces are maintained at the temperature of 400 and 500 K. The temperature of the hot surface is increased to 600 K. By what factor the net radiation exchange per unit area is increased? ε for hot and cold surfaces are 0.7 and 0.9. [4]