

E-949

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B. E. VIth Semester Examination, May – 2019

BRANCH : MECHANICAL ENGINEERING

HEAT TRANSFER

Time : Three Hours]

[Maximum Marks : 75

[Minimum Marks : 30

Note : Attempt *all* questions from *Section – A* (Objective type questions), *four* questions from *Section – B* (Short answer type questions) and *three* questions from *Section – C* (Long/ Essay type questions).

SECTION – A

[Marks : $1.5 \times 10 = 15$

(Objective Type Questions)

1. Which of the following material has the maximum thermal conductivity at room temperature ?
(a) ☒ Cu (b) Wood (c) Liquid water (d) Air
2. Thermal diffusivity of a substance is [k = thermal conductivity, ρ = density, c = specific heat] :
(a) $\frac{\rho c}{k}$ (b) ☒ $\frac{k}{\rho c}$ (c) $\frac{1}{\rho k c}$ (d) $ck\rho$
3. Critical radius of insulation depends upon :
(a) Thermal conductivity(k) of insulating material only ,
(b) External convective heat transfer coefficient (h) only.
(c) ☒ Both k and h
(d) None of the above
4. Nusselt number is defined as :
(a) Convective heat flux/Conductive heat flux
(b) ☒ Conductive heat flux/Convective heat flux
(c) Convective heat flux/(Conductive heat flux)²
(d) (Conductive heat flux)²/Convective heat flux

P. T. O.

5. Prandtl number is defined as [k = thermal conductivity, μ = viscosity, c = specific heat]
- (a) $\frac{kc}{\mu}$ (b) $\frac{k\mu}{c}$ (c) $\frac{\mu c}{k}$ (d) $ck\mu$
6. $\frac{\text{Buoyancy force}}{\text{viscous force}}$ is known as :
- (a) ☒ Reynolds number (b) Grashoff number
(c) Peclet number (d) Nusselt number
7. Fouling factor (R_f) is given by :
- [U_{dirty} = heat transfer coefficient for dirty heat exchanger tubes,
 U_{clean} = heat transfer coefficient for clean heat exchanger tubes]
- (a) $R_f = U_{\text{dirty}} - U_{\text{clean}}$ (b) $R_f = U_{\text{dirty}} + U_{\text{clean}}$
(c) $R_f = \frac{1}{U_{\text{dirty}}} + \frac{1}{U_{\text{clean}}}$ (d) $R_f = \frac{1}{U_{\text{dirty}}} - \frac{1}{U_{\text{clean}}}$
8. In a double-pipe heat exchanger, 10,000 kg/hr of oil ($C_p = 2.095$ kJ/kg-K) is cooled from 80°C to 50°C by 8,000 kg/hr of water ($C_p = 4.18$ kJ/kg-K) entering at 25°C. What will be the LMTD ($U = 300$ W/m²-K) ?
- (a) 35.12°C (b) 33.21°C (c) 30.25°C (d) 27.17°C
9. Effectiveness of counter-flow heat exchanger for capacity ratio of 1 is given by (NTU = number of transfer unit)
- (a) NTU-1 (b) NTU(1+NTU) (c) $1 - e^{-NTU}$ (d) $1 + NTU$
10. 3-D, steady state, heat conduction equation with heat generation and constant thermal conductivity is given by [T = temperature, α = thermal diffusivity, τ = time]
- (a) $\nabla^2 T = \frac{1}{\alpha} \frac{\partial T}{\partial \tau}$ (b) $\nabla^2 T = 0$
(c) $\nabla^2 T + \frac{q}{k} = 0$ (d) ☒ None of the above

SECTION - B

[Marks : 6 × 4 = 24]

(Short Answer Type Questions)

1. Determine the steady state heat transfer through a double pane window, 0.8 m high, 1.5 m wide, consisting of two 4mm thick glass layer ($k = 0.78$ W/m-k), separated by a 10 mm thick stagnant layer of air ($k = 0.026$ W/m-k). Inside temperature of room air is maintained at 20°C with a convective heat transfer coefficient of $h_a = 10$ W/m²-k, outside air temperature is -10°C and convective heat transfer coefficient on the outside is $h_b = 40$ W/m²-K. Also determine the overall heat transfer coefficient.

(2)

2. Electronic power devices are mounted to a heat sink having an exposed surface area of 0.045 m^2 and an emissivity of 0.8 . When the device dissipates a total power of 20 W and air and surroundings are at 27°C , the average sink temperature is 42°C . Determine the convective heat transfer coefficient.

$$h_c = \frac{(75)^4 - (27)^4}{75 - 27}$$

3. What do you mean by hydrodynamic and thermal boundary layer? Also state the importance of these layers in heat transfer.

4. Using dimensional analysis, derive the expression for heat transfer coefficient in forced convection in terms of Nusselt number, Reynolds number and Prandtl number.

5. How are heat exchangers are classified? Discuss briefly different types of heat exchangers.

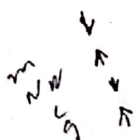
6. Explain the following terms for heat exchangers : (i) LMTD, (ii) Fouling factor, (iii) NTU, (iv) Effectiveness

SECTION - C

[Marks : $12 \times 3 = 36$]

(Long Answer Type Questions)

1. Derive the expression for LMTD of a parallel flow heat exchanger. Also state clearly the assumptions.
2. A shell and tube counter flow heat exchangers uses copper tubes ($k = 380 \text{ W/m-K}$). 20 mm ID and 23 mm OD. Inside and outside film coefficient are $5000 \text{ W/m}^2\text{-K}$ and $1500 \text{ W/m}^2\text{-K}$ respectively. Fouling factors on the inside and outside may be taken as 0.0004 and $0.001 \text{ m}^2\text{-K/W}$ respectively. Calculate the overall heat transfer coefficient based on (i) outside surface and (ii) inside surface.
3. A square plate heater of size $15 \text{ cm} \times 15 \text{ cm}$ is inserted between two slabs. Slab A is 2 cm thick ($k = 50 \text{ W/m-K}$) and slab B is 1 cm thick ($k = 0.2 \text{ W/m-K}$). The outside heat transfer coefficient on both sides of A and B are $200 \text{ W/m}^2\text{-K}$ and $50 \text{ W/m}^2\text{-K}$, respectively. Temperature of surrounding air is 25°C . If the rating of heater is 1 kW . Determine : (a) Maximum temperature in the system, (b) outer surface temperature of two slabs.
4. With the help of suitable examples, explain all the three modes of heat transfer. Also discuss the mechanism of combined heat transfer.
5. Define thermal conductivity. How does thermal conductivity vary with temperature for solid, liquid and gases? What are the factors affecting the thermal conductivity of a material?



$$Q = -kA \frac{dT}{dx}$$

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B. E. VI Semester (Main & Re Exam) Examination, May – 2019

PRODUCTION PROCESS

Branch : ME

Time : Three Hours]

[Maximum Marks : 75

[Minimum Marks : 30

Note : Attempt *all* questions from *Section – A* (Objective type questions), *four* questions from *Section – B* (Short answer type questions) and *three* questions from *Section – C* (Long/ Essay type questions).

SECTION – A

[Marks : $1.5 \times 10 = 15$

(Objective Type Questions)

Note : Attempt *all* questions of the following :


1. What is mean clearance ?

- (a) Maximum size of hole minus maximum size of shaft
- (b) Minimum size of hole minus minimum size of shaft
- (c) Mean size of hole minus mean size of shaft
- (d) Average of both size of shaft and hole

2. Why tolerances are given to the parts ?

- (a) Because its impossible to make perfect settings
- (b) To reduce weight of the component
- (c) To reduce cost of the assembly
- (d) To reduce amount of material used

P. T. O.

3. In pressure die costing, what is the minimum pressure that can be applied ?
- (a) ~~50~~ kg/cm² (b) 70 kg/cm²
(c) 60 kg/cm² (d) 80 kg/cm²
4. Alloys of which of the following metal is not used for hot chamber die casting ?
- (a) Tin (b) ~~Zinc~~ (c) Lead (d) Iron
5. Which of the following factors is not considered in regards with directional solidification ?
- (a) Riser diameter (b) Riser location
(c) Riser height (d) Metal to be casted
6. Which of the following components is mainly manufactured by performing metal forging ?
- (a) Piston (b) Connecting rod
(c) Engine block (d) Crank case
7. Which of the following metal forming processes performs squeezing out of material through a hole ?
- (a) Forging (b) Drawing
(c) Rolling (d) Extrusion
- 
8. During rolling process, the thickness of work piece squeezed is called what ?
- (a) Shaft (b) Bore (c) Draft (d) Core
9. Which of the following is correct about chip thickness ratio 'r' ?
- (a) $r < 1$ (b) $r = 1$
(c) $r > 1$ (d) None of the mentioned

10. Which of the following assumption is *not* valid for merchant circle diagram ?

- (a) Continuous chips (b) ✓ Discontinuous chips
(c) Cutting edge remains sharp (d) No built up edge

SECTION – B

[Marks : $6 \times 4 = 24$]

(Short Answer Type Questions)

Note : Attempt any *four* questions of the following.

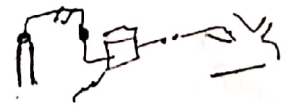
1. Differentiate between Hole Basis System and Shaft Basis System.
2. Differentiate between soldering and brazing. Write their application also.
3. Explain briefly about Cupola process. How will you calculate the metal charge of a cupola in order that the produced casting can have a desired compositions ?
4. With neat sketch, explain elements of a gating system. ✓ 7 3/40
5. Explain the role of moisture in moulding sands. ✓ 2

SECTION – C

[Marks : $12 \times 3 = 36$]

(Long Essay Type Questions)

Note : Attempt any *three* questions of the following.



1. Explain the principle of AJM. Mention some of the specific application and also discuss in detail about AJM process variables that influence the rate of material removal and accuracy in machining.
2. Explain the need for the development of unconventional ^{mach} mashing process by considering any four simple cases of your own interest.
3. What is "Directional Solidification" of casting ? Explain it with the help of a diagram, and also discuss casting defects.

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4. Write short notes on any *three* :

- (a) Types of rolling mills
 - (b) 3-2-1 principles in jigs
 - (c) Thermit welding
 - (d) Gating system elements
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E-951**B. E. VIth Semester (Main & Re-Exam) Examination, May – 2019****DESIGN OF MACHINE ELEMENTS**

Branch : ME

Time : Three Hours]

[Maximum Marks : 75

[Minimum Marks : 30

Note: Attempt *all* questions in Section – A, *four* questions from Section – B and *three* questions from Section – C.

SECTION – A[Marks : $1.5 \times 10 = 15$

- Failure of material is called fatigue when it fails :
 - at the elastic limit
 - below the elastic limit
 - at the yield point
 - below the yield point
- In cyclic loading, stress concentration is more serious in :
 - Brittle material
 - Ductile material
 - Brittle and ductile material
 - Elastic material
- The surface finish factor for a mirror polished material is :
 - 0.45
 - 0.65
 - 0.85
 - 1
- The notch sensitivity q is expressed in terms of fatigue stress concentration factor K_f and theoretical stress concentration factor K_t as :
 - $\frac{K_f + 1}{K_t + 1}$
 - $\frac{K_f - 1}{K_t - 1}$
 - $\frac{K_t + 1}{K_f + 1}$
 - $\frac{K_t - 1}{K_f - 1}$
- For maximum power, the velocity of the belt will be :
 - $\sqrt{\frac{T}{m}}$
 - $\sqrt{\frac{T}{2m}}$
 - $\sqrt{\frac{T}{3m}}$
 - $\sqrt{\frac{T}{4m}}$

P. T. O.

6. A leaf spring in automobiles is used :

(a) to apply force	(b) to measure force
(c) to absorb force	(d) to store strain energy
7. When helical spring is cut into halves, the stiffness of the resulting spring will be :

(a) Same	(b) Double
(c) One-half	(d) One forth
8. A cone clutches have become absolute because of :

(a) Small one angle	(b) Exposure to dirt
(c) Difficult in disengaging	(d) All of these
9. In thrust bearing, the load acts :

(a) Along the axis of rotation	(b) Parallel to the axis of rotation
(c) Perpendicular to the axis of rotation	(d) In any direction
10. The contact ratio for gears is :

(a) Zero	(b) Less than one
(c) Greater then one	(d) None of these

SECTION – B

[Marks : $4 \times 6 = 24$]

1. Write Soderberg's equation and state its application to different type of loading.
2. How are ends of belt joined ? For horizontal bells which side (tight or slack) of the belt should run on the top and why ?
3. Explain what do you understand by A.M. Wahl's factor and state its importance in the design of helical springs ?
4. What is meant by hydrodynamic lubrications ? List the basic assumption used in the theory of hydrodynamic lubrication.
5. How do you express the life of a bearing ? What is an average or medium life ?
6. What is Tredgold's approximation about the formative number of teeth on bevel gear ?

(2)

SECTION – C

[Marks : $3 \times 12 = 36$]

1. A bronze spur pinion rotating at 600 rpm drives a cast iron spur gear of a transmission ratio of 4 : 1. The allowable static stresses for bronze pinion and cast iron gear are 84MPa and 105MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8mm. The face width of both the gears is 90mm. Find the power that can be transmitted from the stand point of strength. Check the gear for wear.
 2. Select a single row deep groove ball bearing for a radial load of 4000 N and an actual load of 5000 N, operating at a speed of 1600 rpm for an average life of 5 years at 10 hours per day. Assume uniform and steady load.
 3. Design 20° involute worm and gear to transmit 10KW with worm rotating at 1400 rpm and to obtain a speed reduction of 12 : 1. The distance between the shafts is 225 mm.
 4. Write short notes on the following :
 - (a) Interference in involute gear
 - (b) Rocklash
 - (c) Addendum cone diameter
 - (d) Hobbing
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B. E. Vith Semester (Main & Re-Exam) Examination, May – 2019

AUTOMOBILE ENGINEERING

Branch : ME

Time : Three Hours]

[Maximum Marks : 75

[Minimum Marks : 30

Note : Attempt all questions in Section – A, four questions from Section – B and three questions from Section – C.

SECTION – A

[Marks : $1.5 \times 10 = 15$

1. The unit as broke power is :
 - (a) Kilo Newton
 - (b) Kilo Watt
 - (c) Kilo Pascal
 - (d) Kilo Newton Metre
2. Which is the common component between a petrol and a diesel engine ?
 - (a) Crank Shaft
 - (b) Dynamo
 - (c) Exhaust silencer
 - (d) Spray nozzle
3. Diesel engine usually work on :
 - (a) Otto cycle
 - (b) Duel cycle
 - (c) .Diesel cycle
 - (d) Stirling cycle
4. The clutch is located between the transmission and the :
 - (a) Engine
 - (b) Rear axle
 - (c) Propeller shaft
 - (d) Differential
5. The smallest gears inside the differential casing are :
 - (a) Pinion gears -
 - (b) Sun gears
 - (c) Side gears
 - (d) Ring gears

P. T. O.

6. In circulating ball type steering gears, the balls travel between the ball and :
 - (a) Gear rack
 - (b) Worm wheel
 - (c) Steering wheel shaft
 - (d) Worm shaft
7. Brake fade is :
 - (a) Loss of pedal
 - (b) Loss of friction
 - (c) Loss of hydraulic fluid
 - (d) None of these
8. Spring eyes in case of cars are usually lined to the :
 - (a) Bronze bushes
 - (b) Rubber bushes
 - (c) Steel bushes
 - (d) Metal bushes
9. The contact breaker gap should be set :
 - (a) Before adjusting dwell angle
 - (b) After adjusting dwell angle
 - (c) First after starting the engine
 - (d) After setting spark plug gap
10. The colour of negative plate of a lead acid battery is :
 - (a) Brown
 - (b) Grey
 - (c) White
 - (d) Black

SECTION - B

[Marks : $4 \times 6 = 24$]

1. What do you understand by automobile engineering ? Give a brief history of automobile stressing the milestones in its development.
2. Compare the two stroke and four stroke engines and give the reasons of their application to different automobiles. Give *two* example of each.
3. What is the function of clutch in an automobile ? Illustrate the construction and working of a single plate dry disc clutch.
4. What is the function of a gear box ? Give a brief discussion of various gear basis used in automobiles.
5. Distinguish between "Semi-floating" and "fully-floating" rear axles with the aid of suitable sketches and explain their relative merits and demerits.

6. Discuss the importance of tyre inflation. What are the effects of under-inflation and over-inflation on the life of a tyre?

SECTION - C

[Marks : $3 \times 12 = 36$]

1. (a) What is steering? Which are the different type of steering systems employed? Explain with a neat sketch the Ackerman's steering system.
- (b) Describe the various components of a steering gear with neat sketch.
2. (a) What are the essential difference between mechanical brakes and hydraulic braking system?
- (b) Write notes on :
- Leaf springs
 - Coil springs
 - Torsion for bar
 - Tapered leaf springs
3. (a) Enlist various spark plug defects. Explain their probable causes and suitable remedies in each case.
- (b) Explain following terms :
- Battery voltage
 - Battery capacity
 - Battery efficiency
 - Battery rating
4. (a) Give the circuit diagram for the changing of a battery with the help of a generator and briefly indicate the function of each component.
- (b) Draw a simplified wiring circuit for the lighting system of a car and discuss the same.

