

MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END EXAMINATION

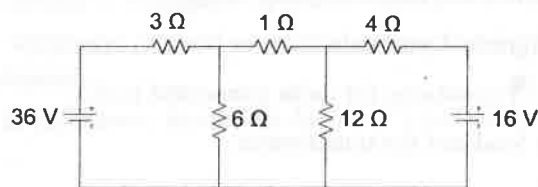
B.Tech. (Agri.Engg.)

Semester : III Academic Year : 2006-2007
Course No. : EOES 232 Title : Electrical Engineering - I
Credits : 3 (2+1)
Day & Date : TUESDAY, 21.11.2006 Time : 9-00 to 12-00 Total Marks : 80

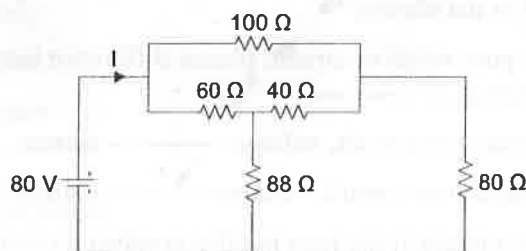
- Note :
1. Solve ANY FIVE questions from SECTION "A".
 2. All questions from SECTION "B" are compulsory.
 3. All questions carry equal marks.
 4. Draw neat diagrams wherever necessary.

SECTION "A"

- Q.1 a) Obtain delta – star connection. (5)
b) State and explain Thevenin's Theorem. (5)
- Q.2 a) Find current flowing through 1Ω resistance by superposition theorem. (5)



- b) Find current I. (5)



- Q.3 a) Prove that for sinusoidal a.c. supply $I_{rms} = 0.707 I_m$. (5)
b) An a.c. voltage of 50 Hz frequency has a peak value of 10 V. (5)
- i) Write an equation to calculate the instantaneous value of the voltage.
 - ii) Write an equation for a current having a maximum value of 5 A and lagging the voltage wave by 45° .
 - iii) Find average and effective values of the voltage and current.

(P.T.O.)

- Q.4 a) A resistance of 5Ω , inductance 10 mH and capacitance $200\ \mu\text{F}$ are connected in series and the combination is connected across 230 V , 50 Hz supply. Calculate the current flowing through the circuit and the power factor. (5)
- b) The power taken by a 3 phase, 400 V motor is measured by the two wattmeter method and the $W_1 = 460\text{ W}$, $W_2 = 780\text{ W}$. Find power factor of motor and current taken by motor. (5)
- Q.5 a) Explain composite series magnetic circuit. (5)
- b) Derive the relation for dynamically induced emf. (5)
- Q.6 a) Explain all day efficiency of a transformer. (5)
- b) The no load current of a transformer is 5 A at 0.3 power factor when supplied at 230 V , 50 Hz . The number of turns on the primary winding is 200 . Calculate: i) the maximum value of flux in the core. (5)
- ii) the core loss
- iii) the magnetizing current.
- Q.7 Write short notes on (Any two): (10)
- a) Magnetic hysteresis.
- b) $V - I$ equations for delta connected load.
- c) No load test for transformer.
- d) Filters.

SECTION "B"

- Q.8 Fill in the blanks: (10)
- For pure resistive circuit, phasor difference between voltage and current vector is -----.
 - In inductive circuit, voltage ----- current.
 - In capacitive circuit, voltage ----- current.
 - Two closely lying long parallel conductors carrying currents in opposite direction ----- each other.
 - Permeability in a magnetic circuit is analogous to ----- in an electric circuit.
 - According to Lenz's law, the current induced in a coil always ----- the cause producing it.
 - Transformer works on the production of ----- induced emf.

8. Energy stored in a coil depends on the ----- of the current passing through it.
9. Kirchoff's first law deals with currents meeting at a ----- of a network.
10. Division of current in a parallel circuit is directly proportional to the ---- ----- of the branches.

Q.9 State True or False: (10)

1. In parallel combination, the equivalent resistance is less than the least among the resistors.
2. An ideal constant current source has an internal resistance of zero.
3. Greater the leakage coefficient, better the magnetic circuit.
4. Whenever a conductor cuts magnetic flux, an emf is induced in it.
5. The power factor of an a. c. circuit can lie between 0 and ± 1 .
6. The unit of admittance, conductance and susceptance is siemens.
7. In a 3 phase, star connected system, line current equals phase.
8. The commercial efficiency of a transformer is about 95%.
9. Two – wattmeter method gives true power in a 3-phase system only if it is balanced.
10. When in resonance, the power factor of a parallel a. c. circuit is unity.

Q.10 Define: (10)

1. Phase sequence
2. Frequency
3. Resistance
4. Reluctance
5. Flux
6. Magnetic circuit
7. Voltage regulation
8. Amplitude
9. Form factor
10. Peak factor



MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD,
PUNE
SEMESTER END EXAMINATION

B.Tech. (Agri. Engg.)

Semester : III Academic Year : 2006-2007
Course No. : AG-ECON 236 Title : Agricultural Economics and Farm
Credits : 3 (2+1) Management
Day & Date : MONDAY, 20.11.2006 Time : 9-00 to 12-00 Total Marks : 80

- Note :
1. Solve ANY FIVE questions from SECTION "A".
 2. All questions from SECTION "B" are compulsory.
 3. All questions carry equal marks.
 4. Draw neat diagrams wherever necessary.

SECTION "A"

- Q.1 Define Economics. Discuss the scope and importance of economics.
- Q.2 What is perfect competition? Discuss how price is determined under the condition of Perfect Competition.
- Q.3 Enlist the different methods of calculating depreciation. Explain any two of them.
- Q.4 Define Farm Management. Enlist the principles of Farm Management and explain any one of them with example.
- Q.5 What is meant by farm budgeting? Enlist and explain the different types of budgeting with example.
- Q.6 Explain the different types of Farm Efficiency measures.
- Q.7 Write short notes (Any two):
- 1) Law of demand
 - 2) Types of Loan
 - 3) Management of Labour

SECTION "B"

- Q.8 Define the following:
- | | |
|------------------------|--------------------|
| (i) Benefit Cost Ratio | (ii) Oligopoly |
| (iii) Law of Supply | (iv) Utility |
| (v) Goods | (vi) Wealth |
| (vii) Agril. Economics | (viii) Consumption |
| (ix) Credit | (x) Variable cost |

(P.T.O.)

Q.9 Fill in the blanks:

1. When value is expressed in terms of money is called -----.
2. A single seller controls the market in -----.
3. Straight line is a method of computing -----.
4. Family labour income is gross income less Cost -----.
5. When T.P. increases M.P. will be -----.
6. Factor – Factor relationship guides the farmers to minimize -----.
7. A change in demand with the change in price is called -----.
8. Large number of buyers and sellers in ----- market.
9. Extension of demand means that more is offered at a ----- price.
10. Demand curve is a ----- presentation of demand schedule.

Q.10 State True or False:

1. As the price of commodity increased the supply of it generally get contracted.
2. The repayment period of Medium term loan is 60 months.
3. Transportation creates time utility.
4. Level of maximum profit is obtained where $MC = MR$.
5. In production function IInd stage is Irrational.
6. Sunshine is the example of free good.
7. Wealth is capital.
8. A budget is prepared for the change in single activity from complete budget is called partial budget.
9. The cost which does not vary with the level of out put is called as fixed cost.
10. Contraction of supply means that less is offered at a lower price.



MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END EXAMINATION

B.Tech. (Agri. Engg.)

Semester : III
Course No. : FMP 235
Credits : 3 (2+1)
Day & Date : FRIDAY, 17.11.2006

Academic Year : 2006-2007
Title : Farm Power
Time : 9-00 to 12-00

Total Marks : 80

- Note :
1. Solve ANY FIVE questions from SECTION "A".
 2. All questions from SECTION "B" are compulsory.
 3. All questions carry equal marks.
 4. Draw neat diagrams wherever necessary.

SECTION "A"

- Q.1 (a) Derive equation for efficiency of the diesel cycle.
(b) Give the difference between CI and SI engines.
- Q.2 (a) Describe "valve timing diagram". What is the meaning of firing interval and firing order?
(b) Explain centrifugal governing system of IC engine.
- Q.3 (a) Give the necessity of cooling system in engine. Explain in short thermo siphon cooling system.
(b) Explain the principle of battery ignition system.
- Q.4 (a) Why clutch is necessary in tractor? Give the classification of clutch used in tractor.
(b) Explain the working of hydraulic brakes.
- Q.5 A four-wheel tractor weighing 3000 kg has a draw bar power of 30 P.S. It pulls a trail implement at a speed of 5 kmph on ground level. The center of gravity of the tractor is 80 cm ahead of rear axle and 100 cm above the ground, wheel base is 2.5 m. total contact area of rear wheel is 1000 cm^2 . The point of hitch is located 40 cm above the ground surface and 30 cm behind the rear axle. Assuming angle of internal friction as 30° and cohesion coefficient as 0.1 kg/cm^2 , calculate:
(a) angle of inclination of the line of pull, (b) soil reaction at rear and front wheels,
(c) maximum pull, weight transfer if angle of inclination remains unchanged.
- Q.6 Write short notes on: (Any four)
- (1) Working principle of differential
 - (2) Power take off
 - (3) Final drive
 - (4) Fuel pump
 - (5) Constant mesh gear box
 - (6) Selection criteria for tractor.

(P.T.O.)

- Q.7 (a) Give the procedure for determination of center of gravity of a tractor.
- (b) Find out B.H.P. of 4 stroke, 4 cylinder I.C. engine, which has cylinder bore as 12 cm, stroke length as 15 cm and speed of crankshaft is 1000 rpm. Assume frictional h.p. 25 and mean effective pressure 7 kg/cm^2 .

SECTION "B"

Q.8 Define:

- (1) Scavenging (2) Carburetion (3) Cetane number
- (4) Trailed implements (5) Tractive efficiency (6) Net traction coefficient
- (7) Governor regulation (8) Motion resistance ratio (9) Specific fuel consumption
- (10) Volumetric efficiency

Q.9 State True or False:

1. In tractor, the most economical speed of engine is 1400 rpm.
2. The spark plug gap in spark plug is kept between 0.5 to 0.8 mm.
3. "Turning circle" of tractor is measured at the speed of not exceeding 2 kmph.
4. Speed of cam shaft is exactly half of the speed of crank shaft in 4 stroke engine.
5. A tractor with less gear ratio should be operated at lower speeds.
6. In pressure cooling of I.C. engine the boiling point decreases approximately up to 1.4°C for each 500 m elevation above mean sea level.
7. The rocker arm is generally used in the steering mechanism of crawler tractor.
8. Draw bar is the least efficient method of transmitting power of tractor to useful work.
9. Mounted implements are rigidly attached with tractor by 3-point linkage.
10. In tractor the swinging drawbar is used when short turn than width is required.

Q.10 Choose the correct answer:

1. The size of front wheel of tractor varies from -----.
a) 4-16 to 7.5-16 b) 4-10 to 8-16 c) 4-12 to 8-20 d) 4-8 to 6-10
2. While turning the tractor on curved path the speed of outer wheel of tractor should be -----
a) less than inner wheel b) about 15 kmph c) greater than 15 kmph
d) more than inner wheel
3. As per ASAE standards the PTO speed under operating load is equal to ----
a) 540 ± 10 rpm b) 150 ± 10 rpm c) 640 ± 20 rpm d) 150 ± 20 rpm
4. Stuck thermostat valve can cause the problem of -----.
a) failure to develop full power b) over heating of engine c) failure to start
d) less thermal efficiency.
5. During compression stroke of 4 stroke engine the volume of air in cylinder becomes about -----.
a) 1/5 part of its original volume b) 2 times the original volume
c) 1/10 part of its original volume d) 1/16 part of its original volume.
6. The device used to regulate fuel supply in the main jet of carburetor is called ---
-----.
a) economiser b) throttle c) automiser d) choke.
7. In I.C. engines the function of tappet is to -----
a) close the valves b) open the valves c) close or open the valves
d) deliver lubricating oil.
8. In differential unit of tractor the bevel pinion is mounted at the end of -----.
a) output shaft of gear box b) cam shaft c) crank case shaft
d) connecting rod.
9. The fundamental law of hydro statistics or mechanics of fluid was given by –
a) Blasie Pascal b) Wischmeir and Smith c) Kepner d) Norman.
10. A chemically correct Air fuel mixture for engine is -----
a) 15:1 b) 10:1 c) 12:1 d) 20:1.



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SEMESTER END EXAMINATION

B.Tech. (Agri. Engg.)

Semester : III

Academic Year : 2006-2007

Course No. : BS-MATH 235

Title : Mathematics - III

Credits : 3 (2+1)

Day & Date : WEDNESDAY, 22.11.2006 Time : 9-00 to 12-00

Total Marks : 120

- Note :
1. Solve ANY FIVE questions from SECTION "A".
 2. All questions from SECTION "B" are compulsory.
 3. All questions carry equal marks.
 4. Draw neat diagrams wherever necessary.

SECTION "A"

- Q.1 A) Prove the linearity of Laplace transforms (5)
B) Find the Laplace transforms of i) $e^{3t} \cdot \sin 4t$ ii) $\sin t \cdot \cos t$ (10)
- Q.2 A) Solve the initial value problem: (10)
 $y'' + 25y = 10 \cos 5t$ given that $y(0) = 2$ and $y'(0) = 0$
B) Find the inverse Laplace transform of $F(s) = 1 / (s^2 - 5s + 6)$ (5)
- Q.3 A) Prove the D'Moivre's theorem for positive internal index. (5)
B) Expand $\cos 5\theta$ in terms of $\cos\theta$ and $\sin\theta$ (10)
- Q.4 A) Show that $f(z) = z^2 + e^z$ is analytic. (10)
B) Prove that $(d / dz) \cos hz = -\sin hz$ (5)
- Q.5 Expand : $f(x) = x \sin x + \cos x$, $f(x+ 2\pi) = f(x)$ into a Fourier series in the interval $[-\pi, \pi]$. (15)
- Q.6 A) Find cube roots of the complex number $(1 + i)$ (8)
B) Solve $9y_{k+2} - 6y_{k+1} + y_k = 0$ (7)
- Q.7 A) Solve $y_{k+2} - 4y_k = 9k^2$ (8)
B) State and prove Cauchy Reiman equation in cartesian form. (7)

(P.T.O.)

SECTION "B"

Q.8 State / Define: (15)

1. Forward Difference, Backward Difference and Central Difference.
2. Necessary and Sufficient conditions for a function $f(z)$ to be analytic.
3. Odd function and an even function.
4. First shifting property of Laplace transformation.
5. Dirichlet's conditions.

Q.9 State True or False, if false correct and rewrite it. (15)

1. Fourier expansion of an even function does not contain the a_0 term.
2. The homogeneous equation of first order and first degree is always exact.
3. A particular solution of a differential equation does not contain arbitrary constant.
4. $L(\sin t \cdot \cos t) = L(\sin t) L(\cos t)$.
5. The number 1 has only one cube root in the complex plane.

Q.10 Fill in the blanks: (15)

1. $L\{t^n f(t)\} = \text{-----}$.
2. If $z = -(3+i)$ then $|z| = \text{-----}$.
3. $(\cos \Theta + i \sin \Theta)^n = \text{-----}$.
4. $L[e^{-t}] = \text{-----}$, $L[\sin at] = \text{-----}$, $L[\cos at] = \text{-----}$.
5. $\Delta^2 Y_n = \text{-----}$.



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SEMESTER END EXAMINATION

B.Tech. (Agri. Engg.)

Semester : III Academic Year : 2006-2007
Course No. : BS-STAT 236 Title : Statistics
Credits : 2 (1+1)
Day & Date : WEDNESDAY, 15.11.2006 Time : 9-00 to 11-00 Total Marks : 40

- Note :
1. Solve ANY FIVE questions from SECTION "A".
 2. All questions from SECTION "B" are compulsory.
 3. All questions carry equal marks.
 4. Draw neat diagrams wherever necessary.

SECTION "A"

- Q.1 What do you mean by measures of central tendency? Give the formulae for arithmetic, geometric and harmonic means for ungrouped data.
- Q.2 Differentiate between absolute and relative measures of dispersion. State the formulae for deviation, standard deviation and coefficient of variation for grouped data
- Q.3 Explain the terms – (i) trial (ii) simple event (iii) compound event (iv) mutually exclusive events and (v) probability of an event.
- Q.4 What do you mean by theoretical probability distribution? Define Binomial Distribution and state its properties.
- Q.5 Differentiate among simple, partial and multiple correlations. State the formulae for simple correlation coefficient and regression coefficient of Y on X.
- Q.6 Explain the terms – (i) null and alternative hypothesis (ii) degrees of freedom (iii) type I and type II errors and (iv) level of significance.
- Q.7 Write short note on: (Any two)
- (1) Normal distribution (2) Paired 't' test
(3) Chi-square test (4) Additive theorem of probability

SECTION "B"

- Q.8 State True or False:
1. Arithmetic mean is capable of further algebraic treatment.
 2. Standard deviation of the series 4,4,4,4,4,4 is 4.
 3. Probability of sure event is zero.
 4. Chi-square distribution is one of the discrete theoretical probability distribution.
 5. Multiple regression model has one independent and one dependent variable.

(P.T.O.)

Q.9 Fill in the blanks:

1. In ----- distribution mean, median and mode are equal.
2. Standard deviation is one of the absolute measures of -----.
3. Probability of null event is -----.
4. ----- technique is useful for prediction purpose.
5. Significant difference between two independent sample variances is tested by -
----- test.

Q.10 State the formulae for:

1. Median for grouped data
2. Mode for grouped data
3. Weighted mean
4. Variance
5. Rank correlation coefficient



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SEMESTER END EXAMINATION

B.Tech. (Agri. Engg.)

Semester : III Academic Year : 2006-2007
Course No. : AG-CHEM 235 Title : Food Science
Credits : 3 (2+1)
Day & Date : THURSDAY, 16.11.2006 Time : 9-00 to 12-00 Total Marks : 80

- Note :
1. Solve ANY FIVE questions from SECTION "A".
 2. All questions from SECTION "B" are compulsory.
 3. All questions carry equal marks.
 4. Draw neat diagrams wherever necessary.

SECTION "A"

- Q.1 a) State biological functions of lipids. (4)
b) State names of essential fatty acids (2)
c) Distinguish between saturated and unsaturated fatty acids. (4)
- Q.2 Define the term contamination of food. State common spoilages occurring in Fresh fruits and vegetables during handling and storage. (10)
- Q.3 a) Classify enzymes (IUB) with suitable examples (5)
b) Define amino acids. Classify them based on their polarity with suitable examples. (5)
- Q.4 a) Define the term vitamins and state major function of fat soluble vitamins (6)
b) What are proteins? State their functions. (4)
- Q.5 Write short notes on: (Any two) (10)
1. Essential oils
 2. Control of bacterial growth
 3. Function of carbohydrates
 4. Nucleic acids
 5. Water soluble vitamins
- Q.6 a) Describe how fresh milk is contaminated. (2)
b) State the names of indigenous fermented milk products. (3)
c) State factors affecting compositions of milk. (5)
- Q.7 a) Define the term protein. (2)
b) State the classification of proteins. (3)
c) State classification of carbohydrates with suitable examples. (5)

(P.T.O.)

SECTION "B"

Q.8 Fill in the blanks:

(10)

1. ----- is a non reducing sugar.
2. Thiamine is a ----- soluble vitamin.
3. Fats are esters of ----- with -----.
4. ----- are building blocks of proteins.
5. ----- sugar is present in the milk.
6. Catalytically active enzyme is termed as -----.
7. ----- is the example of homopolysaccharids.
8. Deficiency of vitamin C causes -----.
9. Genetic information from parents to offsprings is carried in -----.

Q.9 Define the following:

(10)

- | | | |
|-------------------|--------------------|-----------------|
| 1. Food | 2. Sterilization | 3. Iodine value |
| 4. Reducing sugar | 5. Monosaccharides | 6. Nutrient |
| 7. Holo enzyme | 8. Nucleic acid | 9. Lipids |
| 10. Acid value | | |

Q.10 State True or False:

(10)

1. Banana is non-climatic type of fruit.
2. All proteins are enzymes.
3. Oils are liquids at 30°C.
4. Vitamin A is water soluble.
5. All micro organisms decrease the food value.
6. Lactose is sweeter than sucrose.
7. Amylase is component of starch.
8. Ribose is present in DNA molecule.
9. Conversion of unsaturated fatty acids into saturated fatty acids is known as hydrogenation.
10. Enzymes act like growth regulators.



MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END EXAMINATION

B.Tech. (Agri. Engg.)

Semester : III Academic Year : 2006-2007
Course No. : APE 232 Title : Heat and Mass Transfer
Credits : 3 (2+1)
Day & Date : SATURDAY, 18.11.2006 Time : 9-00 to 12-00 Total Marks : 80

- Note :
1. Solve ANY FIVE questions from SECTION "A".
 2. All questions from SECTION "B" are compulsory.
 3. All questions carry equal marks.
 4. Draw neat diagrams wherever necessary.

SECTION "A"

- Q.1 Derive an expression for heat transfer by conduction through hollow sphere. 10
Assume that the sphere with inner radius r_1 , outer radius r_2 , inner and outer surface temperature t_1 and t_2 respectively and is made up of a material whose thermal conductivity is k .
- Q.2 a) Write a short note on "Fundamental Transport Process" 5
b) What is Fouling factor? How it affects the heating surfaces? 5
- Q.3 Establish the following relationship using Newton Rikhman Law 10
$$\frac{1}{U} = \frac{1}{h_i} + \frac{\Delta x}{k} + \frac{1}{h_o}$$
- Q.4 State the difference between 10
a) Heat and Mass Transfer
b) Natural convection and Forced convection
c) Black body and Opaque body
d) Parallel flow and Counter flow heat exchanger
e) Steady state and Unsteady state heat conduction
- Q.5 A steam main of 8 cm inside diameter and 9.5 cm outside diameter is lagged with two successive layers of insulation. The layer in contact with pipe is 3.75 cm asbestos with $k = 0.11 \text{ W/m}^0\text{K}$ and the asbestos layer is covered with 1.5 cm thick magnesia insulation with $k = 0.067 \text{ W/m}^0\text{K}$. The inside film heat transfer coefficient is $290 \text{ W/m}^2^0\text{K}$ and outside film heat transfer coefficient is $7.0 \text{ W/m}^2^0\text{K}$. Conductivity of pipe material is $45 \text{ W/m}^0\text{K}$. Calculate the steady state heat loss from the steam for 50 m length of pipe if the steam passing is at 350^0C and the ambient temperature is 30^0C .

(P.T.O.)

- Q.6 a) Interior wall of a furnace is maintained at 1000°C . The wall thickness is 0.6m; 1m wide and 1.5m long of material with thermal conductivity $0.4 \text{ W/m}^{\circ}\text{K}$. The temperature of outside wall is 200°C . Determine the heat flow through wall and also the thermal resistance to heat flow. 5
- b) A counter flow heat exchanger cools 1400 kg/hr of oil having heat capacity $3 \text{ kJ/kg}^{\circ}\text{K}$ from 100°C to 30°C by water (heat capacity $4.1868 \text{ kJ/kg}^{\circ}\text{K}$) initially at 20°C . The quantity of water fed is 1300 kg/hr . Calculate water outlet temperature and heat transfer area for overall heat transfer coefficient of $4000 \text{ kJ/hr m}^2^{\circ}\text{K}$. 5
- Q.7 a) State the Stefan Boltzman Law. Classify the bodies depending upon their radiating properties. 5
- b) Enlist different types of heat exchangers. Illustrate any one in detail. 5

SECTION "B"

- Q.8 Define the following: 10
- a) Thermal Diffusivity
 - b) Mass Transfer
 - c) Thermal Resistance
 - d) Pool boiling
 - e) Emmissivity
- Q.9 Fill in the blanks: 10
- a) The wall of several heterogeneous layers is called as _____.
 - b) _____ is calculated by dividing the thermal conductivity with the product of specific heat and mass density.
 - c) When Reynolds number between 2100 to 2300 then flow is termed as _____.

- d) The term $\frac{C_p \mu}{k}$ is called as _____.
- e) _____ body does not transmit any radiation.
- f) The mass transfer occurs due to gradient in _____.
- g) Logarithmic mean temperature difference (LMTD) for heat exchanger is given by _____.
- h) As the thickness of insulation increases the rate of heat transfer _____.
- i) When temperature of the system changes with time, the system is in _____ heat conduction.
- j) _____ condensation occurs on contaminated surfaces and when impurities are present.

Q.10

State True or False:

10

- a) In SI system, thermal conductivity is expressed as kcal/hr m²°C
- b) The value of Stefan Boltzman constant in S.I. is $5.667 \times 10^{-8} \text{ W/m}^2\text{K}^4$.
- c) The $\frac{hl}{k}$ is termed as Nusselt number.
- d) White body absorbs the entire radiations incident on it.
- e) $\frac{Q}{A}$ is known as heat flux density or thermal loading of heating surface.
- f) Condensation of a vapour to a liquid involves a change of phase of fluid with small heat transfer coefficient.
- g) In mass transfer, Fourier's Law gives diffusion rate.
- h) In counter flow heat exchangers, less surface area is required than that in parallel flow, for given heat transfer rate.
- i) $\frac{\rho V L}{\mu}$ is called as Grashoff number
- j) The heat transfer by radiation takes place by means of electromagnetic waves.

