جـــــــمهوريـــــة العــــــراق

وزارة التعليم العالي و البحث العلمي

جامعة الفرات الأوســـــط التقنية

الكلية التقنية الهندســية / النجــف

قسم هندسة تقنيات السيارات

المرحلة الثالثة

أسئلة الامتحان النهائي للعام الدراسي

٢٠١٥-٢٠١٦

الدور الثاني

شعبة ضمان الجودة و الأداء الجامعي

قسم السيارات

Higher Education & Scientific Research
-Awsat Technical University
chnical Engineering College
mobile Department

Subject: Heat Transfer
Class: 3rd Stage
Exam. Time: 3 Hours
Examiner: Dr. H. GH. Hameed

Final Examination (first attempt) for the academic year 2015-2016

Notes: 1-Answer five questions only. 2- Question 1 is required and answer it on the Exam. paper.

Q1/ choose the correct answer: (40 M)

1. The units of heat flux are:
• Watts • Joules • Joules / meters^2 • Watts / meters^2 • Joules / Kg.K

2. The units of thermal conductivity are:
• Watts / meters^2 K • Joules • Joules / meters^2 • Joules / second meter K
• Joules / Kg K

3. The heat transfer coefficient is defined by the relationship
• $h = m\ Cp\ \Delta T$ • $h = k / L$ • $h = q / \Delta T$ • $h = Nu\ k / L$ • $h = Q / \Delta T$

4. Which of these statements is not true?
• conduction can occur in liquids • conduction only occurs in solids
• thermal radiation can travel through empty space • convection cannot occur in solids • gases do not absorb thermal radiation

5. What is the heat flow through a brick wall of area 10m^2, thickness 0.2m, k = 0.1 W/m K with a surface temperature on one side of 20°C and 10°C on the other?
• 50 Watts • 50 Joules • 50 Watts / m^2 • 200 Watts • 200 Watts / m^2

6. A solid copper ball of mass 500 grams, when quenched in a water bath at 30°C, cools from 530°C to 430°C in 10 seconds. What will be the temperature of the ball after the next 10 seconds?
• 300°C • 320°C • 350°C • 380 °C
• Not determinable for want of sufficient data

7. The value of the Stefan-Boltzmann constant is:
• 56.7 × 10-6 W/m^{2}K^4 • 56.7 × 10-9 W/m^{2}K^4 • 56.7 × 10-6 W/m^{2}K
• 56.7 × 10-9 W/m^{2}K • 56.7 × 10-6 W/m K

8. The different modes of heat transfer are:
• forced convection, free convection and mixed convection
• conduction, radiation and convection • laminar and turbulent
• evaporation, condensation and boiling • cryogenic, ambient and high temperature

9. Mixed convection refers to:
• combined convection and radiation • combined convection and conduction
• combined laminar and turbulent flow • combined forced and free convection
• combined forced convection and conduction

10. The thermal diffusivity, α , is defined as:
• $= \mu\ Cp / k$ • $= k\ Cp / \rho$ • $= k / \rho\ Cp$ • $= h\ L / k$ • $= L / k$

11. Which of these statements is a correct expression of Fourier's Law

• $q = m C_p \Delta T$ • $q_x = -k\frac{dT}{dx}$ $q_x = -k\frac{\partial T}{\partial x}$ $Q_x = -k\frac{\partial T}{\partial x}$ $Q_x = -k\frac{\partial T}{\partial y}$

12. Which of the following is NOT a boundary condition?
• $T_{x=L} = 50°C$ • $q_{x=L} = q_{input}$ • $-k(dT/dx)_{x=L} = h(T_s - T_f)$
• $T_{y=L/2} = T_0(1 - x/L)$ • k = 16 W/m K

قسم السيارات
٣/ب

Higher Education & Scientific Research
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12. Which of the following is NOT a boundary condition?
• $T_{x=L} = 50°C$ • $q_{x=L} = q_{input}$ • $-k(dT/dx)_{x=L} = h(T_s - T_f)$
• $T_{y=L/2} = T_0(1 - x/L)$ • k = 16 W/m K

13. The statement $T_{x=0} = T_0$, means that:

- the temperature at x = 0 is zero
- the temperature at x = 0 is constant
- the temperature at x = L is zero
- the temperature at x = L is constant
- the surface at x = 0 is adiabatic

14. The statement $-k(dT/dx)_{x=L} = h(T_s - T_f)$ means that:

- the temperature at x = L is constant
- the heat flux at x = L is constant
- heat transfer by convection is zero at x = L
- heat transfer by conduction is zero at x = L
- heat transfer by convection equals that by conduction at x = L

15. A large value of heat transfer coefficient is equivalent to:

- a large thermal resistance
- a small thermal resistance
- infinite thermal resistance
- zero thermal resistance
- it depends on the fluid temperature

16. Calculate the heat flow through a 100 m length of stainless steel (k = 16 W/m K) pipe of 12mm outer diameter and 8 mm inner diameter when the surface temperature is 100°C on the inside and 99.9°C on the outside.

- 800 W
- 670 W
- 3 kW
- 2.5 kW
- 2 kW

17. Applied to a pipe, the critical insulation radius describes a condition when:

- the flow is turbulent
- the heat flow is infinite
- the heat flow is a maximum
- the heat flow is a minimum
- the heat flow is zero

18. For 1-D conduction in a plane wall, the temperature distribution is:

- parabolic
- logarithmic
- linear
- quadratic
- trigonometric

19. A good insulator has:

- a large value of k
- a small value of k
- an infinite value of k
- a large value of h
- a large value of h and a small vale of k

20. Which of the following is NOT an example of a fin?

- ribs on an electric motor casing
- a concrete balcony protruding from a wall
- a turbine blade in a hot gas path
- an insulated pipe carrying high pressure steam
- porcupine spines

21. Which is NOT a boundary condition for a fin analysis ?

- $T \rightarrow T_f$ as $L \rightarrow \infty$
- $(dT/dx)_{x=L} = 0$
- $-k(dT/dx)_{x=0} = h_{tip}(T_{x=L} - T_f)$
- hP/kA_c = constant
- Tx=L = constant

22. A heat transfer correlation is used to:

- estimate Re
- estimate the fluid velocity
- estimate the fluid thermal properties
- estimate the heat transfer coefficient
- estimate radiation effects

23. Which of these is NOT a fluid property

- density
- thermal conductivity
- viscosity
- Prandtl number
- Reynolds number

24. Which statement is true of forced convection?

- Nu α Gr Pr
- Nu α Re Pr
- Nu α Pr (only)
- Nu α M (Mach number)
- Nu α Re (only)

25. Which statement is true of free convection?

- h is always constant
- h depends on external velocity
- h depends on temperature difference, ΔT
- h is independent of temperature difference, ΔT
- the flow is always laminar

The definition of the Prandtl number is:

• $Pr = \rho\, Cp / \mu$ • $Pr = \mu\, Cp / \rho$ • $Pr = \rho\, Cp / k$ • $Pr = \mu\, Cp / k$ • $Pr = h\, L / k$

27. A coolant fluid at 30°C flows over a heated flat plate maintained at a constant temperature of 100°C. The boundary layer temperature distribution at a given location on the plate may be approximated as $T = 30 + 70 \exp(-y)$ where y (in m) is the distance normal to the plate and T is in °C. If thermal conductivity of the fluid is 1.0 W/mK, the local convective heat transfer coefficient (in W/m2K) at that location will be:

• 0.2 • 1 • 2.4 • 5 • 10

28. In forced convection over a flat plate, what is the appropriate length scale for the average Nusselt number?

• the boundary layer thickness, δ
• the width (i.e. in the direction across the flow) of the plate
• the thickness of the plate
• the distance from the leading edge (i.e., in the direction of the flow), x
• the overall length of the plate, L

29. The Prandtl number is a measure of

• Compressibility effects • Turbulence level • Forced / Free convection effects
• viscosity • relative thickness of velocity and thermal boundary layers

30. Which is NOT an example of a heat exchanger?

• automotive radiator • central heating radiator • electric kettle • engine oil cooler
• cooling tower

31. A car radiator may be classified as what sort of heat exchanger?

• shell and tube • plate fin • tube fin • double pipe • direct contact

32. For the same inlet and outlet temperatures of hot and cold fluids, the Log Mean Temperature Difference (LMTD) is:

• Greater for parallel flow heat exchanger than for counter flow heat exchanger.
• Greater for counter flow heat exchanger than for parallel flow heat exchanger.
• Same for both parallel and counter flow heat exchangers.
• Dependent on the properties of the fluids.
• None of these.

33. To increase the overall heat transfer coefficient in an air to water heat exchanger one would:

• increase the flow rate of the water • increase the flow rate of the air and the water
• increase the flow rate of the air • increase the air pressure • none of these

34. The 'NTU' (Number of Transfer Units) in a heat exchanger is given by which one of the following?

• UA / C_{min} • UA / C_{max} • UA / E • C_{max} / C_{min} • C_{min} / C_{max}

35. A heat exchanger is used to cool 1 kg/s of oil (Cp = 2 kJ/kg.K) from 90˚C to 70˚C with a 0.5 kg/s flow of water (Cp = 4 kJ/kg.K). If the water has an inlet temperature of 10˚C, what is the water exit temperature?

• 10˚C • 20˚C • 30˚C • 40˚C • 50˚C

Q2/A/ Prove that the critical thickness of insulation for a spherical shell is: (5 M)

$$r_c = 2k_{ins} / h_{out}$$

Q2/B/ A spherical container of negligible thickness holding a hot fluid at 140 °C and having an outer diameter of 0.4 m is insulated with three layers of each 50 mm thick insulation of k1 = 0.02: k2 = 0.06 and k3 = 0.16 W/mK. The outside surface temperature is 300 °C. Determine: (10 M)

1- the heat loss

2- interface temperatures of insulating layers.

Q3/ A motor body is 360 mm in diameter (outside) and 240 mm long. Its surface temperature should not exceed 55 °C when dissipating 340 W. Longitudinal fins of 15 mm thickness and 40 mm height are proposed. The convection coefficient is 40W/m^2 °C. Determine the number of fins required. Atmospheric temperature is 30 °C. Thermal conductivity = 40 W/m °C. (15 M)

Q4/ Consider a nodal configuration of Fig. 1. Derive the finite-difference equations under steady-state conditions for the following situations: (15 M)

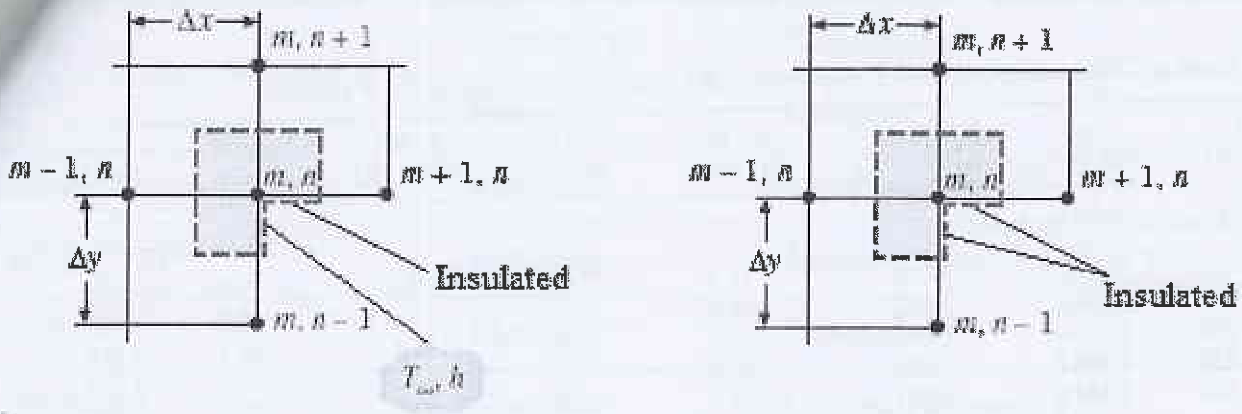
(a) The horizontal boundary of the internal corner is perfectly insulated and the vertical boundary is subjected to the convection process (T_∞, h).

(b) Both boundaries of the internal corner are perfectly insulated.

Q5/ The crankcase of an automobile is approximately 0.6 m long, 0.2 m wide, and 0.1 m deep (see Fig. 2). Assuming that the surface temperature of the crankcase is 350 K, estimate the rate of heat flow from the crankcase to atmospheric air at 276 K at a road speed of 30 m/s. Assume that the vibration of the engine and the chassis induce the transition from laminar to turbulent flow so near to the leading edge that, for practical purposes, the boundary layer is turbulent over the entire surface. Neglect radiation and use for the front and rear surfaces the same average convection heat transfer coefficient as for the bottom and sides. (15 M)

Q6/ A parallel flow heat exchanger is used to cool 4.2 kg/min of hot liquid of specific heat 3.5 kJ/kg K at 130 °C. A cooling water of specific heat 4.18 kJ/kg K is used for cooling purpose of a temperature of 15 °C. The mass flow rate of cooling water is 17 kg/min. The overall heat transfer coefficient is 1100 W/m^2 K and the heat exchanger area is 0.30 m^2. calculate the following: (15 M)

1. Outlet temperature of hot liquid
2. Outlet temperature of water
3. Effectiveness of heat exchanger



(a) (b)

Figure 1

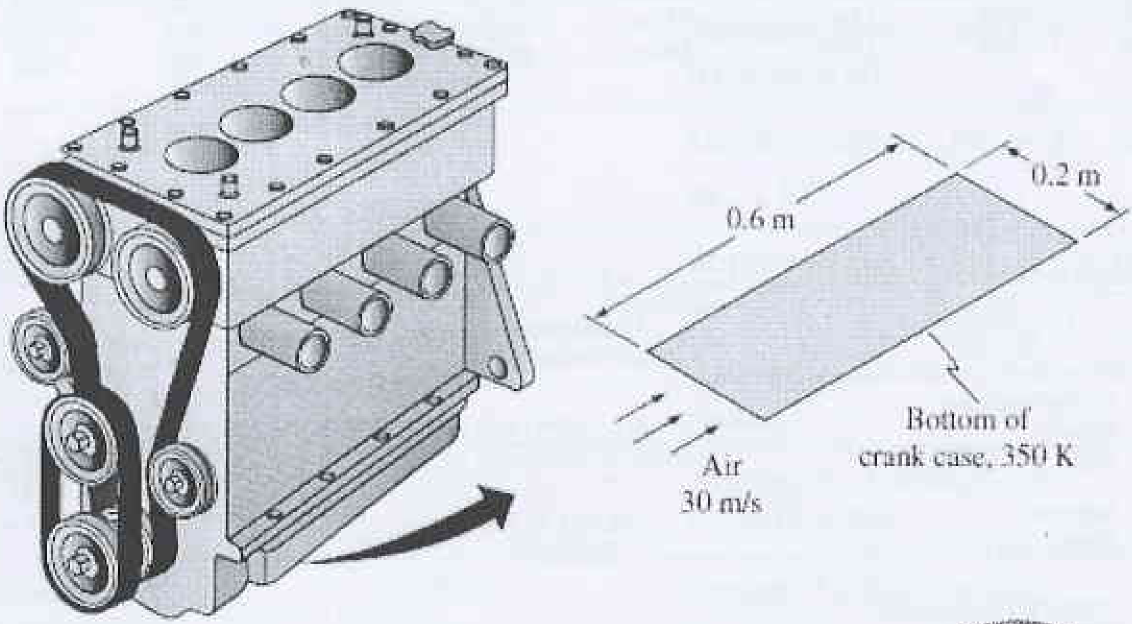


Figure 2

Head of Dep.

Examiner

Good Luck

TABLE Thermophysical Properties of Gases at Atmospheric Pressure

T (K)	ρ (kg/m^3)	c_p (kJ/kg · K)	$\mu \cdot 10^7$ (N · s/m^2)	$\nu \cdot 10^6$ (m^2/s)	$k \cdot 10^3$ (W/m · K)	$\alpha \cdot 10^6$ (m^2/s)	Pr
Air, $\mathcal{M}$ = 28.97 kg/kmol							
100	3.5562	1.032	71.1	2.00	9.34	2.54	0.786
150	2.3364	1.012	103.4	4.426	13.8	5.84	0.758
200	1.7458	1.007	132.5	7.590	18.1	10.3	0.737
250	1.3947	1.006	159.6	11.44	22.3	15.9	0.720
300	1.1614	1.007	184.6	15.89	26.3	22.5	0.707
350	0.9950	1.009	208.2	20.92	30.0	29.9	0.700
400	0.8711	1.014	230.1	26.41	33.8	38.3	0.690
450	0.7740	1.021	250.7	32.39	37.3	47.2	0.686
500	0.6964	1.030	270.1	38.79	40.7	56.7	0.684
550	0.6329	1.040	288.4	45.57	43.9	66.7	0.683
600	0.5804	1.051	305.8	52.69	46.9	76.9	0.685
650	0.5356	1.063	322.5	60.21	49.7	87.3	0.690
700	0.4975	1.075	338.8	68.10	52.4	98.0	0.695
750	0.4643	1.087	354.6	76.37	54.9	109	0.702
800	0.4354	1.099	369.8	84.93	57.3	120	0.709

TABLE Temperature distribution and heat loss for fins of uniform cross section

Case	Tip Condition ($x = L$)	Temperature Distribution θ/θ_b	Fin Heat Transfer Rate q
A	Convection heat transfer: $h\theta(L) = -kd\theta/dx\|_{x=L}$	$\dfrac{\cosh m(L-x) + (h/mk)\sinh m(L-x)}{\cosh mL + (h/mk)\sinh mL}$	$M\dfrac{\sinh mL + (h/mk)\cosh mL}{\cosh mL + (h/mk)\sinh mL}$
B	Adiabatic: $d\theta/dx\|_{x=L} = 0$	$\dfrac{\cosh m(L-x)}{\cosh mL}$	$M \tanh mL$
C	Prescribed temperature: $\theta(L) = \theta_L$	$\dfrac{(\theta_L/\theta_b)\sinh mx + \sinh m(L-x)}{\sinh mL}$	$M\dfrac{(\cosh mL - \theta_L/\theta_b)}{\sinh mL}$
D	Infinite fin ($L \rightarrow \infty$): $\theta(L) = 0$	e^{-mx}	M

$\theta \equiv T - T_\infty$ $\quad m^2 \equiv hP/kA_c$

$\theta_b = \theta(0) = T_b - T_\infty$ $\quad M \equiv \sqrt{hPkA_c}\,\theta_b$

ummary of convection heat transfer correlations for external flow[a,b]

on	Geometry	Conditions[c]
$Re_x^{-1/2}$	Flat plate	Laminar, T_f
$= 0.664\, Re_x^{-1/2}$	Flat plate	Laminar, local, T_f
$Nu_x = 0.332\, Re_x^{1/2}\, Pr^{1/3}$	Flat plate	Laminar, local, T_f, $Pr \gtrsim 0.6$
$\delta_t = \delta\, Pr^{-1/3}$	Flat plate	Laminar, T_f
$\bar{C}_{f,x} = 1.328\, Re_x^{-1/2}$	Flat plate	Laminar, average, T_f
$\overline{Nu}_x = 0.664\, Re_x^{1/2}\, Pr^{1/3}$	Flat plate	Laminar, average, T_f, $Pr \gtrsim 0.6$
$Nu_x = 0.564\, Pe_x^{1/2}$	Flat plate	Laminar, local, T_f, $Pr \lesssim 0.05$, $Pe_x \gtrsim 100$
$C_{f,x} = 0.0592\, Re_x^{-1/5}$	Flat plate	Turbulent, local, T_f, $Re_x \lesssim 10^8$
$= 0.37x\, Re_x^{-1/5}$	Flat plate	Turbulent, T_f, $Re_x \lesssim 10^8$
$Nu_x = 0.0296\, Re_x^{4/5}\, Pr^{1/3}$	Flat plate	Turbulent, local, T_f, $Re_x \lesssim 10^8$, $0.6 \lesssim Pr \lesssim 60$
$\bar{C}_{f,L} = 0.074\, Re_L^{-1/5} - 1742\, Re_L^{-1}$	Flat plate	Mixed, average, T_f, $Re_{x,c} = 5 \times 10^5$, $Re_L \lesssim 10^8$
$\overline{Nu}_L = (0.037\, Re_L^{4/5} - 871)\, Pr^{1/3}$	Flat plate	Mixed, average, T_f, $Re_{x,c} = 5 \times 10^5$, $Re_L \lesssim 10^8$, $0.6 \lesssim Pr \lesssim 60$
$\overline{Nu}_D = C\, Re_D^m\, Pr^{1/3}$ (able 2)	Cylinder	Average, T_f, $0.4 \lesssim Re_D \lesssim 4 \times 10^5$, $Pr \gtrsim 0.7$
$\overline{Nu}_D = C\, Re_D^m\, Pr^n (Pr/Pr_s)^{1/4}$ (able 4)	Cylinder	Average, T_∞, $1 \lesssim Re_D \lesssim 10^6$, $0.7 \lesssim Pr \lesssim 500$
$\overline{Nu}_D = 0.3 + [0.62\, Re_D^{1/2}\, Pr^{1/3} \times [1 + (0.4/Pr)^{2/3}]^{-1/4}] \times [1 + (Re_D/282{,}000)^{5/8}]^{4/5}$	Cylinder	Average, T_f, $Re_D\, Pr \gtrsim 0.2$
$\overline{Nu}_D = 2 + (0.4\, Re_D^{1/2} + 0.06\, Re_D^{2/3})\, Pr^{0.4} \times (\mu/\mu_s)^{1/4}$	Sphere	Average, T_∞, $3.5 \lesssim Re_D \lesssim 7.6 \times 10^4$, $0.71 \lesssim Pr \lesssim 380$, $1.0 \lesssim (\mu/\mu_s) \lesssim 3.2$

TABLE 7 *(Continued)*

Correlation		Geometry	Conditions[c]
$\overline{Nu}_D = 2 + 0.6\, Re_D^{1/2}\, Pr^{1/3}$		Falling drop , Sphere	Average, T_∞
$\overline{Nu}_D = C_1\, Re_D^{1/2}$ (Table 5)		Tube bank[d]	Average, $\overline{T}$, $2000 \le Re_D \le 40000$ $Pr \ge 0.7$, $N_L \ge 10$
$\overline{Nu}_D = 1.13 C_1\, Re_D^{1/2}\, Pr^{1/3}$ (Table 5)		Tube bank[d]	Average, $\overline{T}$, $2000 \le Re_D \le 40000$ For other fluids , $Pr \ge 0.7$, $N_L \ge 10$
$\overline{Nu}_D = C\, Re_{D,max}^m\, Pr^{0.36}\left(\frac{Pr}{Pr_s}\right)^{1/4}$ (Table 6)		Tube bank[d]	Average, $\overline{T}$, $1000 \le Re_D \le 2 \times 10^6$, $0.7 \le Pr \le 500$, $N_L \ge 20$
$\overline{Nu}_D = C_1 C_2\, Re_{D,max}^m\, Pr^{0.36}(Pr/Pr_s)^{1/4}$ (Tables 6, 8)	(28)	Tube bank[d]	Average, $\overline{T}$, $10 \le Re_D \le 2 \times 10^6$, $0.7 \le Pr \le 500$

Correlations in this table pertain to isothermal surfaces; for special cases involving an unheated starting length or a uniform surface heat flux. When the heat and mass transfer analogy is applicable, the corresponding mass transfer correlations may be obtained by replacing Nu and Pr by Sh and Sc, respectively.

The temperature listed under "Conditions" is the temperature at which properties should be evaluated.

For tube banks, properties are evaluated at the average fluid temperature, $\overline{T} = (T_i + T_o)/2$.

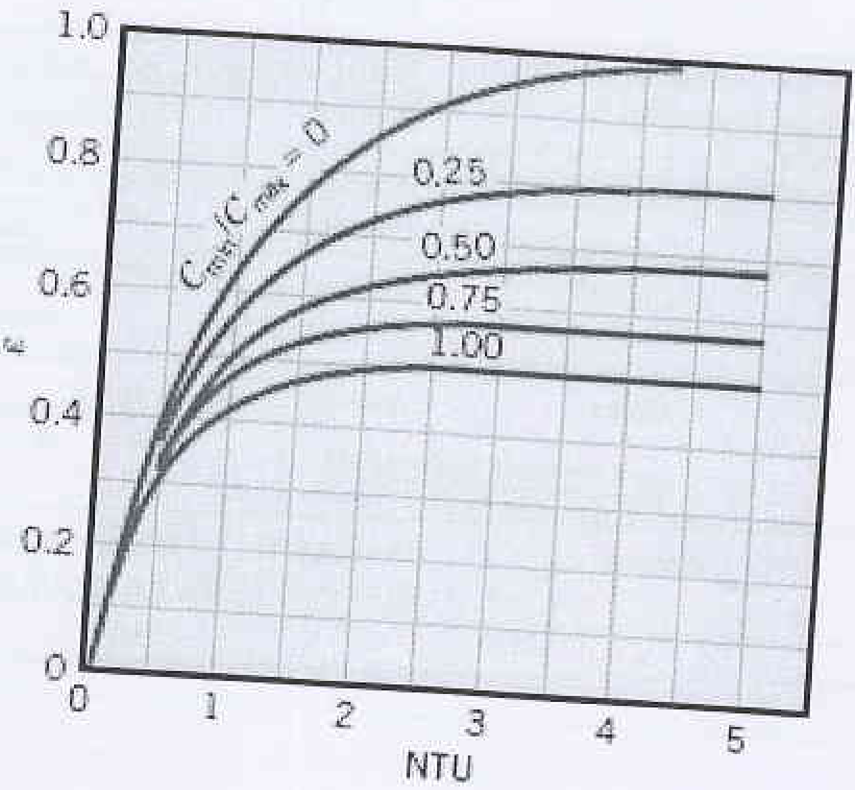


FIGURE Effectiveness of a parallel-flow heat exchanger.

Ministry of Higher Education and Scientific Research
Al-Furat Al-Awsat Technical University
Tech. Eng. Collage – Najaf/ Automobile Tech. Eng. Dept.
Final examination/ 1st try (2015-2016)

ject: Automotive Electronics and Computer Control — Class: 3rd year
me: 3 hours — Date: / 6 / 2016

Notes// 1. Please read the questions carefully, 2. Answer all questions

Q1. Which one of these (a, b, c, d) is the correct answer? Please read carefully? **(10%)**

1. All of the sensors can be used to measure movement or position, EXCEPT:
   a) TP
   b) KS
   c) VSS
   d) CMP

2. Technician A says the microprocessor commands actuators by output drivers. Technician B says that outputs are never controlled by supplying voltage to the actuator. Who is correct?

   a) A only. b) B only. c) Both A and B. d) Neither A nor B.

3. *Two technicians are diagnosing engine starts then stops. Technician A says that this means that the MAP sensor is defective. Technician B says that this indicates that the MAF sensor is defective. Which technician is correct?*

   a) A only. b) B only. c) Both A and B . d) Neither A nor B.

4. Technician A says during the processing function the computer uses input information and compares it to programmed instructions. Technician B says during the output function the computer will put out control commands to various output devices. Who is correct?

   a) A only. b) B only. c) Both A and B . d) Neither A nor B.

5. *Two technicians are diagnosing poor fuel economy. Technician A says that this means that the oxygen sensor is supplying improper information to the PCM. Technician B says that this indicates that air filter is blocked. Which technician is correct?*

   a) A only. b) B only. c) Both A and B . d) Neither A nor B.

6. The main ECU 'input' sensors for calculating ignition timing and injector duration are:
   a) CKP and ECT
   b) CKP and MAP
   c) MAP and IAT
   d) MAF and TP

7. Technician A says. Technician B says an on-off switch sends an analog signal to the computer. magnetic sensor used to send data to the computer concerning the speed of the monitored component. Who is correct?

   a) A only. b) B only. c) Both A and B . d) Neither A nor B.

8. The signal originates from a sensor measuring transmission/transaxle output speed or wheel speed is called :

   a) CMP b) VSS c) CKP d) wheel speed sensor

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Time: 3 hours | **Date: / 6 / 2016**

Notes// 1. Please read the questions carefully, 2. Answer all questions

---

9. Technician A says impact sensor is used in air bag system control. Technician B says impact sensor is used in suspension system control. Who is correct?

   a) A only. b) B only. c) Both A and B . d) Neither A nor B.

10. Electronic system prevents drive wheels from wheel spinning during starting or accelerating on a wet or icy surface is called:

    a) ABS b) EDC c) TCS d) PAS

****

Q2. Answer only five branches: **(25%)**

1. Describe the actuator classifications.
2. Explain the differences between active and passive sensors.
3. Describe how the wheel speed sensor operates to produce a signal.
4. Compare between conductors and insulators.
5. Explain closed loop of the ABS control system.
6. Explain how the power control module(PCM) uses the mass air flow signal.

****

Q3.

A Explain the application and function of the following terms: **(answer only five)** **(10%)**

1. A/F ratio sensor.
2. Knock sensor.
3. Turbocharger Pressure sensor.
4. Ignition module.
5. Electronic clutch control.
6. Vehicle speed sensor.

B Specify the location and problem of the following faults: **(answer only five)** **(10%)**

Open IAT sensor,, shorted CKP sensor,, A faulty ECT sensor,, open MAP sensor,, defective Knock sensor,, shorted injector.

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Ministry of Higher Education and Scientific Research
Al-Furat Al-Awsat Technical University
Tech. Eng. Collage – Najaf/ Automobile Tech. Eng. Dept.
Final examination/ 1st try (2015-2016)

…ect: Automotive Electronics and Computer Control
…me: 3 hours

Class: 3rd year
Date: / 6 / 2016

Notes// 1. Please read the questions carefully, 2. Answer all questions

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Q4. A *Please read the following problems carefully. How can you to diagnosis and repair problem? (Answer only three problems)* **(15%)**

1. **Problem:** Mr. Assed brings his 2013 (TOYATA with multiport EFI) to the shop, saying there is poor engine performance. The ignition system is in good condition.

2. **Problem:** Mr. Ahmed brings his (2014 Ford) into the shop .He explains that the car hard start engine. The ignition and fuel systems are in good condition.

3. **Problem:** Mr. Raid brings in his 2013 (Kia) into the shop, saying there is too rough idling speed.

4. **Problem:** Mr. Ali brings in his 2015 (Nissan) into the shop, saying there poor fuel economy.

Q4. B Explain the need for a EVAP vapor pressure sensor and how does this compare to a MAP sensor? **(10%)**

****

Q5. Answer only four questions: **(20%)**

A// Explain how the power control module(PCM) uses the mass air flow signal.

B// List the position sensors and explain the function of each.

C// Describe the computer locations.

D// What is the difference between AND, NAND, and OR gates?

E// Compare between DC motors and stepper motors.

******************** **WITH BEST WISHES** *********************

Head of dept.

Examiner

قسم السيارات
س/٣

وزارة التعليم العالي و البحث العلمي		المرحلة الثالثة
جامعة الفرات الاوسط التقنية		المادة: التحليلات
الكلية التقنية النجف		الزمن: ثلاث ساعات
قسم هندسة تقنية السيارات		الممتحن: د. وسام احمد عبد الواحد

<u>Attempt all questions.</u>

<u>All questions have equal marks</u>

Q1: A:

Find the functions $f(t)$ which have the following Laplace transforms:

(a) $\frac{6}{s^3}$ (b) $\frac{s+3}{s^2+9}$ (c) $\frac{2s+7}{s^2+4}$

(d) $\frac{s+2}{s^2+4s+5}$ (e) $\frac{s-2}{2s^2+4s+10}$

B: Solve the following differential equations by Laplace transformations:

$$\left(\frac{\partial}{\partial t}y(t)\right)-5y(t)=e^{(5t)}$$

$$\frac{\partial^2}{\partial t^2}y(t)=1-t$$

Assume zero initial conditions.

Q2: Find the Fourier expansion of the following formula:

$f(t)=1-t^2,\ t\in[-1,1].$

Q3: Solve the following partial differential equation by separation of variables:

(Wave equation)	$a^2u_{xx}=u_{tt}$,	$0<x<L,\ \ t>0,$
(Boundary conditions)	$u(0,t)=0$, and	$u(L,t)=0,$
(Initial conditions)	$u(x,0)=f(x)$, and	$u_t(x,0)=g(x).$

Take f(x)=x, and g(x)=0

Q4: Find the root of the following equation numerically:

$f(x) = x - e^{-x}$ start from x=0.

Q5: Use both Simpsons rules to find the integration with 6 increments for the following formula:

F(x)= $e^{x}\sin(x) + x^2$. From 0 to 4.

Q6: Find the value of y(2) for the following differential equation:

$e^{y}\frac{dy}{dx} + x^2y^2 = 2Sin(3x), y(0) = 5$

the step used should be (0.5). Use Euler method.

GOOD LUCK

قسم السيارات
م/٣

Ministry of Higher Education and Scientific Research
Al-Furat Al-Awsat Technical University
Tech. Eng. College – Najaf/Automobile Tech. Eng. Dept.
Final Examination 2016

Subject:Theory of Machines
Time: 3 hours

Class:3[st] year.
Date: / /2016.

Note// Answer four questions only.

Q1

The mechanism shown in fig.(1) has a crank 50 mm radius which rotates at 2000 rev/min. Determine the velocity of the piston for the position shown. Also determine the angular velocity of link AB about A.

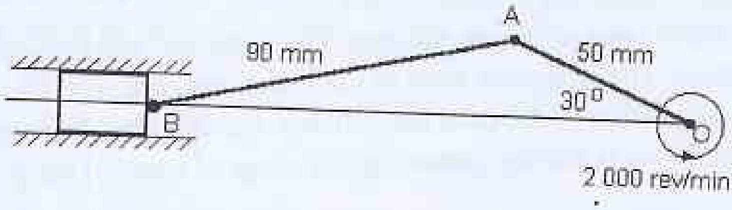

Fig.(1)

(25 MARK)

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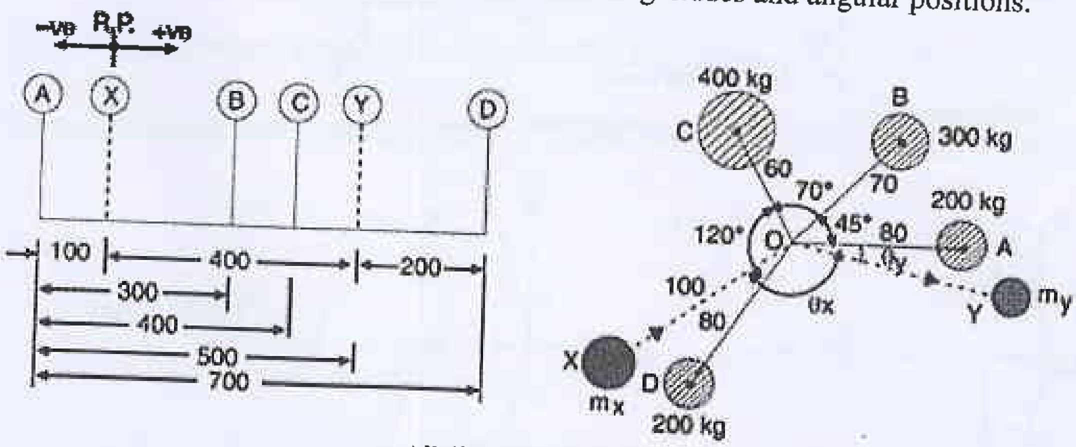
Q2

A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions.



All dimensions in mm.

Fig.(2)

(25 MARK)

Ministry of Higher Education and Scientific Research
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Tech. Eng. College – Najaf/Automobile Tech. Eng. Dept.
Final Examination 2016

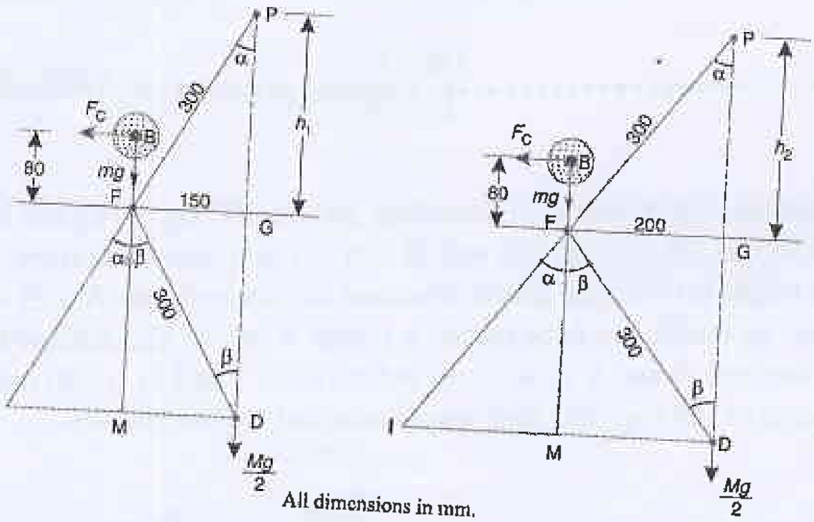
Subject: Theory of Machines
Time: 3 hours

Class: 1st year.
Date: / /2016.

<u>Note//</u> Answer <u>four</u> questions only.

Q5

A **Proell** governor has equal arms of length 300 mm. The upper and lower ends of the arms are pivoted on the axis of the governor. The extension arms of the lower links are each 80 mm long and parallel to the axis when the radii of rotation of the balls are 150 mm and 200 mm. The mass of each ball is 10 kg and the mass of the central load is 100 kg. Determine the range of speed of the governor.



All dimensions in mm.

(a) Minimum position. (a) Maximum position.

Fig.(5)

(25 MARK)

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Note// Answer four questions only.

Q3

The speed ratio of the reverted gear train, as shown in Fig.(3), is to be 12. The module pitch of gears A and B is 3.125 mm and of gears C and D is 2.5 mm. Calculate the suitable numbers of teeth for the gears. No gear is to have less than 24 teeth.

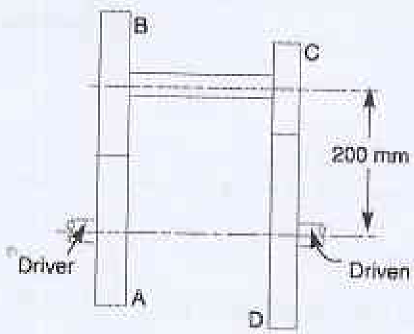

Fig.(3)

(25 MARK)

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Q4

Show that the Ratio of Driving Tensions For Flat Belt Drive is $\frac{T_1}{T_2} = e^{\mu\theta}$

Consider a driven pulley rotating in the clockwise direction as shown in Fig. below

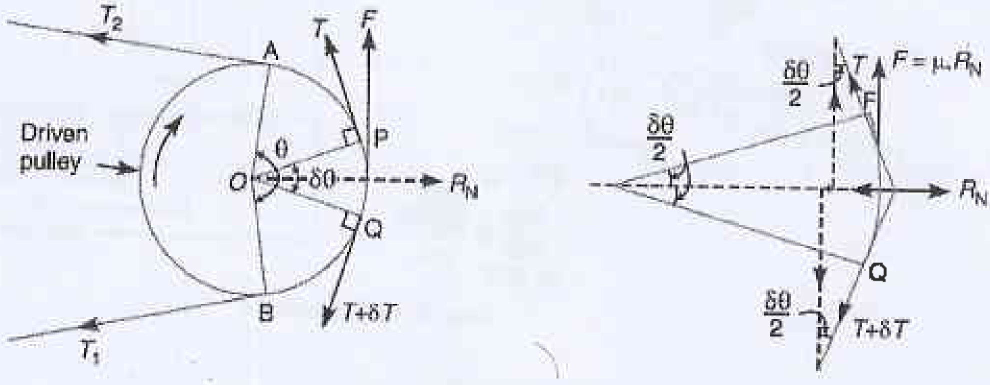


Fig.(4)

(25 MARK)

قسم السيارات
س/٣

Foundation of Technical Education
Technical Collage – Najaf
Automotive Eng. Department
Final Examination

Subject: measurement and control
Class: 3rd Year

Time: 3 Hour
Date: / / 2016
( ) Trial

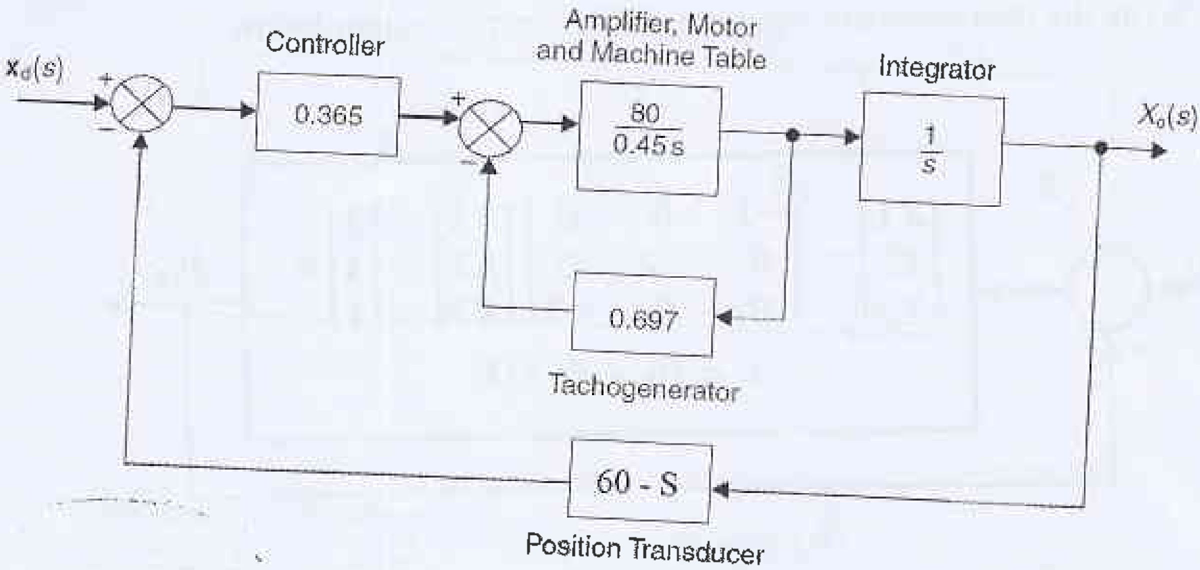
Notes/// 1. Answer all questions 2. For each question (20M) only.

Q.1\ A control system has a transfer function of:

$$G(s) = \frac{8\,(S+1)}{(S+2)^3}$$

What will be the output from the system when it is subject to a unit impulse input?

Q.2\ Design the PID- Controller instead of the P- Controller for the CNC machine tool positional control system described in the block diagram below:



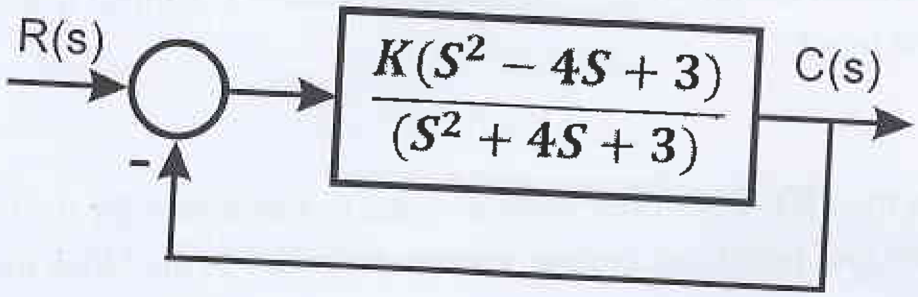
Foundation of Technical Education
Technical Collage – Najaf
Automotive Eng. Department
Final Examination

Subject: measurement and control
Class: 3rd Year

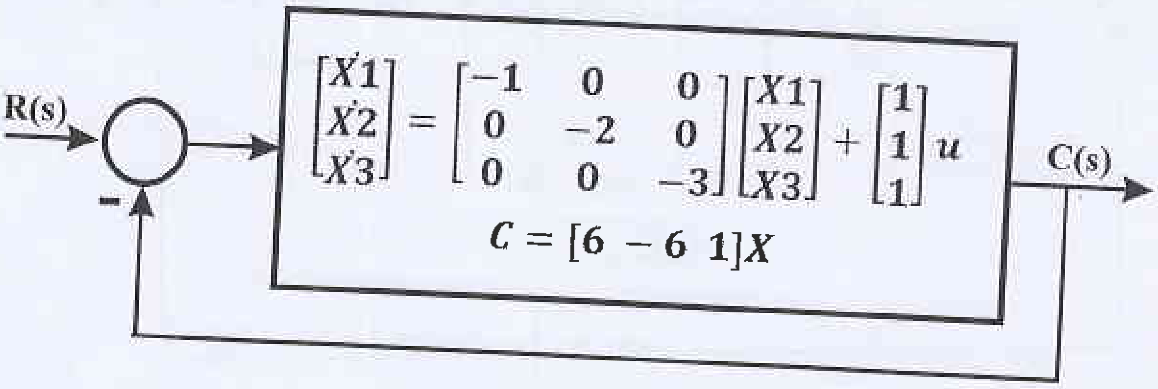
Time: 3 Hour
Date: / / 2016
( ) Trial

Notes/// 1. Answer all questions 2 For each question (20M) only.

Q.3 | Sketch the root locus for the system and discuss the stability.



Q.4 | Write the characteristic equation of the control system below.



Foundation of Technical Education
Technical Collage – Najaf
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Final Examination

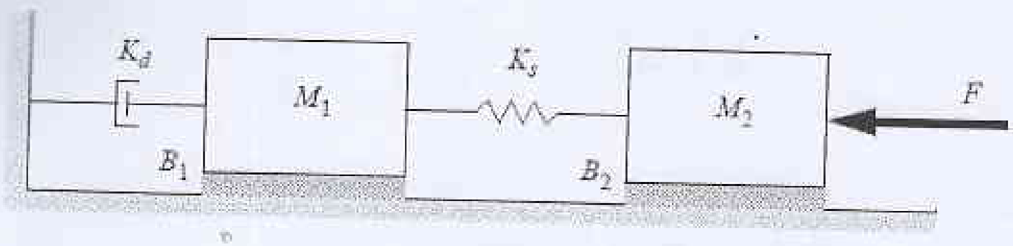
Subject: measurement and control
Class: 3rd Year

Time: 3 Hour
Date: / / 2016
( ) Trial

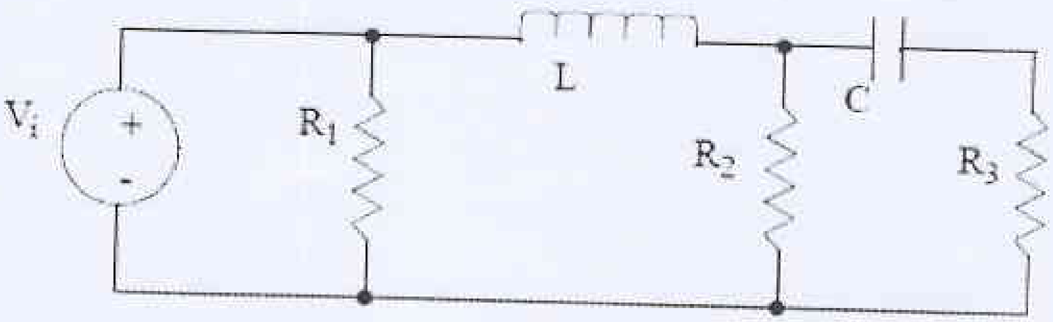
Notes/// 1 Answer all questions 2 For each question (20M) only.

Q.5\ Answer only one branch (A or B)

A) Write the differential equations and its laplace transform for the system **below.**



B) Develop the differential equations and its laplace transform for the electical circuit.



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Jan . 10 . 2016

Examiner
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