جمهورية العراق
وزارة التعليم العالي و البحث العلمي
جامعة الفرات الأوسط التقنية
الكلية التقنية الهندسية / النجف

قسم هندسة تقنيات الطيران

المرحلة الثالثة

أسئلة الفصل الأول للعام الدراسي

٢٠١٦-٢٠١٧

شعبة ضمان الجودة و الأداء الجامعي

قسم الطيران
٣/ط

Ministry of Higher Education & Scientific Research
Al-Furat Al-Awsat Technical University
Najaf Technical Engineering College
Auto. & Aero. Departments

Subject: Heat Transfer
Class: 3rd Stage
Exam. Time: 2 H
Examiner: H. GH. Hameed

First semester Examination for the academic year 2016-2017

Notes: 1- Answer four questions only. 2- All questions have the same mark. 3- Answer Q 1 on the examination paper.

Q1/ Choose the right answer from the following:

i- Steady state heat flow means,

a) Negligible of heat flow.

b) Heat flow independent of time.

c) Uniform rate in temperature rise of a body.

d) No difference of temperature between the bodies.

ii-Consider a medium in which the heat conduction equationis given in its simplest form as

$$\frac{1}{r}\frac{\partial}{\partial r}\left(kr\frac{\partial T}{\partial r}\right)+\frac{\partial}{\partial z}\left(k\frac{\partial T}{\partial z}\right)+\dot{q}=0$$

(a) Is heat transfer steady or transient?
(b) Is heat transfer one-, two-, or three-dimensional?
(c) Is there heat generation in the medium?
(d) Is the thermal conductivity of the medium constant orvariable?

iii-Dirichlet condition, a type of boundary conditions, corresponds to a situation for which the surface is maintained;

a) At constant temperature

b) At constant heat flux

c) With no heat flow (insulated)

d) None of the above

iv- Which of the following expresses thermal diffusivity of a substance in terms of thermal conductivity (k), density (ρ) and specific heat (C),

a) $(\rho^2 kC)$ b) $(1/\rho kC)$ c) $(k/\rho C)$ d) $(k/\rho C^2)$

v- Two walls of same thickness and cross section area have thermal conductivities in the ratio 1:4. If same temperature difference is maintained across the wall faces, the ratio of heat flow q_1/q_2 will be;

a) 0.5 b) 4 c) 0.25 d) 0.4

vi- Consider a layer of insulation which might be installed around a circular pipe. The thermal conductivity of the insulation is (k) and the assembly exposed to an environment with T_∞. The critical thickness of insulation can be obtained as ($r_{cr}=k/h$). The heat transfer will be increased by adding more insulation when;

a) $r_{cr} > r_o$ b) $r_{cr} = r_o$ c) $r_{cr} < r_o$ d) $r_{cr}=0$

vii- The medium in which the conduction occurs is isotropic, means that;

a) The medium is solid and exposed to convection.

b) The thermal conductivity of the medium is a function of the temperature.

c) The value of the thermal conductivity is independent of the coordinate direction.

d) The value of the thermal conductivity is dependent of the coordinate direction.

viii- on heat transfer, fins are used to

a) Increase temperature gradient so as to improve heat transfer.

b) Increase the Biot number to improve heat transfer.

c) Increase surface area to improve heat transfer.

d) Decrease the temperature drop of the flow.

ix- The temperature of a solid surface changes from **27 °C to 627 °C**. The emissive power changes would then increases by the ratio:

a) 6:1 b) 9:1 c) 27:1 d) 81:1

x-A thermally transparent surface of transmissivity0.15, receives 2000 kJ/min of radiation and reflect back 800 kJ/min out of it. The emissivity of the surface is then;

a) 0.15 b) 0.54 c) 0.45 d) 0.4

Q2/ A/ prove that the critical radius of insulation for a spherical shell is:

$r_{cr} = 2k/h$

B/ Air at 20 °C blows over a carbon steel (1%) 2cm thick hot plate (k= 43W/m.°C) 50 by 75cm maintained at 250 °C. The convection heat transfer coefficient is 25W/m^2.°C and that 300W is lost from the plate surface by radiation, calculate the inside plate temperature.

Q3/ A hollow tube composed of two layers. The inner tube is with inner diameter of 0.2m and 0.05m thick and 70W/m. °C thermal conductivity. The outer tube is with 0.01m thick and 1W/m.°C thermal conductivity. A hot fluid with 80 °C flows inside the composed tube with 100W/m^2.°C heat transfer coefficient. The composed tube exposed to the ambient at 20°C and 10W/m^2.°C heat transfer coefficient. Calculate:

a) The overall heat transfer coefficient based on outer area.

b) The amount of heat transfer per unit length.

c) The temperature between the two tube layers.

Q4/ A set of radial aluminum fins (k= 180W/m.K)as shown in Fig. (1) that are to be fitted to a smaller air compressor. The device dissipates 1KW by connecting to the surrounding air which is at 20 °C.Each fin is 100mm long, 30mm height and 5mm thick. The tip of each fin may be assumed to be adiabatic and a heat transfer coefficient h= 15W/m^2.K acting over the remaining surfaces. Estimate the number of fins required to ensure the base temperature (120 °C) does not exceed.

Q5/ Hot water at 85°C flows through a thin-walled coppertube of 30mm diameter. The tube is enclosed by aneccentric cylindrical shell that is maintained at 35°C andhas a diameter of 120mm. The eccentricity, defined asthe separation between the centers of the tube and shell,is 20mm. The space between the tube and shell is filledwith an insulating material having a thermal conductivityof 0.05 W/m. K. Calculate the heat loss per unitlength of the tube, and compare the result with the heatloss for a concentric arrangement.

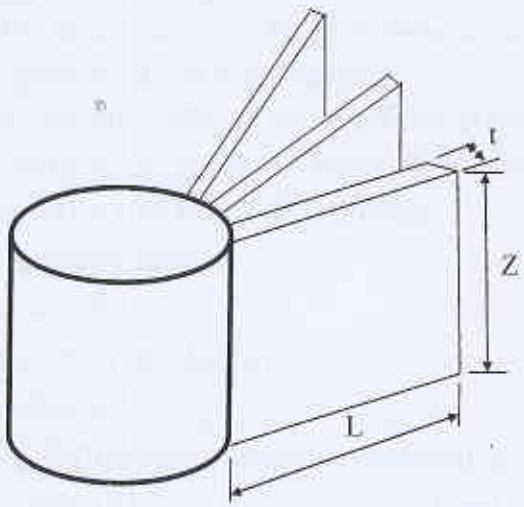

Fig. 1

Head of Dep.

Examiner

Good Luck

قسم الطيران
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قسم الطيران
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القسم : هندسة تقنيات الطيران
المرحلة : الثالثة
المادة: ~~معالج بقيق~~ تصميم
زمن الامتحان: ساعتان
التاريخ: 2016/ 02/

امتحان الفصل الأول- العام الدراسي ٢٠١٥/٢٠١٦

Answer all Questions

Q/1(**20marks**)

1- What are mechanical property when material is subjected to the external load?
A- Compressing. B- Stretching . C- Shear. D- A and B. E- A,B and C.

2- The fusion edges of the two parts to be joined together that leads to a permanent joint is called .....
A- Riveted Joints. B- Welded Joints. C- Screw Joints .

3- What is the name of welding processes that use a combination of heat and pressure?
A- Fusion Welding. B- Gas Welding. C- Forge Welding. D- Both A and B.

4- What is the main considerations involved in the selection of weld type?
A- The shape of the welded. B- The thickness of the plates. C- The direction of the forces applied.
D- all A,B and C.

5- What is the name of fastenings that we can be disassembled without destroying the connecting components?
A- Permanent Fastenings. B- Temporary Fastenings. C- Detachable Fastenings. D- Both B and C.

6- The material used for shafts should have the following properties :
A- low notch sensitivity factor. B- high wear resistant. C- good heat treatment. D- all A,B and C.

7- A shaft is a rotating machine element which is used to transmit power from one place to another, what is the basis of design it?
A- Strength. B- Rigidity. C- stiffness. D- all A,B and C.

8- What type of key is a taper key which fits in a keyway in the hub and is flat on the shaft that is used for comparatively light loads?
A- Flat saddle key. B- Tangent Keys. C- Hollow saddle key. D- all A,B and C.

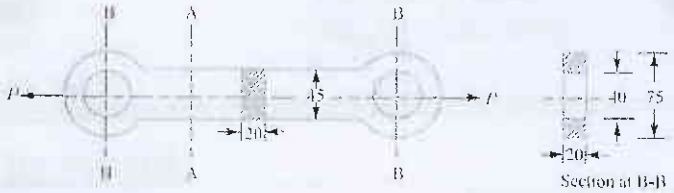
9- What are the basic steps for deriving material indices we should Identify ?
A- Function. B- Objectives. C- Constraints. D- Free Variables C- All A,B,C and D.

10- Shafts are generally manufactured by hot rolling and finished to size by..
A- cold drawing. B- turning . C- grinding. D- A,B and C.

رئيس القسم
د.اسعد عواد

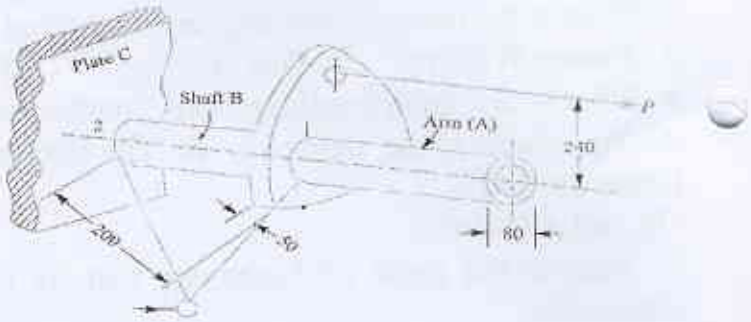
مدرس المادة
أ.م. حسام يحيى عمران

Q2/A cast iron link is required to transmit a steady tensile load of 45 kN . Find the tensile stress induced in the link material at sections A-A and B-B.**(20marks)**



All dimensions in mm.

Q3/ An arm A is welded to a hollow shaft at section '1'. The hollow shaft is welded to a plate C at section '2'. The arrangement is shown , along with dimensions. A force P = 15 kN acts at arm A perpendicular to the axis of the arm. Calculate the size of weld at section '1' and '2'. The permissible shear stress in the weld is 120 MPa.**(30marks)**



All dimensions in mm

Q4/ Find the diameter of a solid steel shaft to transmit 20 kW at 200 r.p.m. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameter when the ratio of inside to outside diameters is 0.5.**(30marks)**

Important application law

$$\tau_{max} = \frac{1}{2}\sqrt{(\sigma_b)^2 + 4\tau^2} \qquad \tau = \frac{2.83T}{\pi s d^2} \qquad \sigma = \frac{p}{A}$$

Torque transmitted by the shaft (T) = $\frac{P \times 60}{2 \times \pi \times N}$ $\qquad \sigma_b = \frac{5.66M}{\pi s d^2}$

$\tau = \frac{\tau_u}{F.S}$ $\qquad$ Torque transmitted by solid shaft (T) = $\frac{\pi}{16} \times \tau \times d^3$

$k = \frac{d_i}{d_o}$ $\qquad$ Torque transmitted by hollow shaft (T) = $\frac{\pi}{16} \times \tau \times d_o^3 \times (1 - k^4)$

قسم الطيران
٣/د

Ministry of Higher Education
& Scientific Research
Furat Al-Awsat Technical University
Najaf Engineering Technical College

Aeronautical Engineering
Technical Department
Mid Exam 2016/2017

Subject: Aircraft Engines
Time: 2 hours
Class level: 3rd Stage

Q1: Figure bellow illustrates a typical single-spool axial-flow turbojet engine. It is required to calculate the distribution of the thrust force for each component (compressor, diffuser, combustion chamber, turbine, jet pipe, and nozzle) with 2 m/s ground velocity .

Prove that the sum of these thrust forces is equal to the thrust force developed by the engine using the usual thrust force equation. (30 M)

	compressor	Diffuser	Combustion Chamber	Turbine	Jet Pipe	Nozzle
Outlet area (m^2)	0.117	0.132	0.374	0.310	0.420	0.214
Outlet velocity (m/s)	120	108	86	267	190	579
Outlet gage pressure (kPa)	658	665	651	155	155	51
Mass flow rate (kg/s)	71.4	71.4	71.4	71.4	71.4	71.4

Q2: The JT9D high bypass ratio turbofan engine at maximum static power ($V0 = 0$) on a sea level, standard day ($P0 = 101.3$ kPa, $T0 = 15$ °C) has the following data: Air mass flow rate through the core is 112 kg/s, the air mass flow rate through the fan bypass duct is 566 kg/s, the exit velocity from the core is 363 m/s, the exit velocity from the bypass duct is 270 m/s and the fuel flow rate into the combustor is 1.96 kg/s. For the case of exhaust pressures equal to ambient pressure ($P0 = Pe$), estimate the following:

(a) The thrust of the engine

(b) The thermal efficiency of the engine (heating value of jet fuel is about 42,700 kJ/kg

(c) TSFC of the engine (30M)

Q3: For a turbofan engine with unchoked **nozzles, prove that** if the fuel-to-air ratio is negligible ($f \approx 0$), the propulsive **efficiency is expressed as:** (40 M)

$$\eta_p = \frac{2u\left[u_{e_h} + \beta u_{e_c} - (1+\beta)u\right]}{u_{e_h}^2 + \beta u_{e_c}^2 - (1+\beta)u^2}$$

Next, plot the relation ηp versus u for the following cases:

β	u (m/s)				u_{ec} (m/s)	u_{eh} (m/s)
0.5	0	200	450	700	750	1000
2.0	0	200	400	600	700	950

Lecturer
Assist. Prof. Dr. Ali Sh. Baqir

Aeronautical Eng. dept. Head
Dr. Assad Awad

قسم الطيران
٣/ط

٣ ط

Ministry of Higher Education & Scientific Research		Subject:Industrial Engineering
Al-Furat Al-Awsat Technical University-Najaf Tech, Eng. College AeronauticalEngineering Dep.	1st-Term Exam./(2016-2017)	Class: 3rd year Time : 2 hr Examiner: Asst.Lect. RoaaJaameel

Note: Answer All Questions

Q1/A: The following are the ignition times of certain upholstery materials exposed to a flame (given to the nearest hundredth of a second):

2.58	2.51	4.04	6.43	1.58	4.32	2.20	4.19
4.79	6.20	1.52	1.38	3.87	4.54	5.12	5.50
5.92	4.56	2.46	6.90	1.47	2.11	2.32	6.75
5.84	8.80	7.40	4.72	3.62	2.46	8.75	7.86

Construction the frequency table and then plot theOgive graph.(15marks)

Q1/B: Define the Pearson's correlation and then explain its equation.(10marks)

Q2/A:A researcher is interested in studying the relationship between porosity and Density of Autoclaved Aerated Concrete (ACC).The researched data about 4834 subjects is given in the following table.

Porosity	Density			Marginal total
	High	Intermediate	Low	
No-pores	700	625	500	1825
Intermediate-pores	660	575	355	1590
High-pores	600	529	290	1419
Marginal total	1960	1729	1145	4834

Do these data provide sufficient evidence about the existence of a relationship between porosity and Density of Autoclaved Aerated Concrete? α =0.05(20 marks)

Q2/B: What are the properties of the frequency histogram?(5marks)

Q3/A: If the average number of defects in the output of spinning and weaving machine 8% per spool find: (15marks)

1-Probability that we find three defect per meter.

2-Probability that we find more than one defect per meter.

3- Probability that we find less than one defect per meter.

Q3/B: What are the conditions (assumptions) of One-Way ANOVA?(10mark)

Q4/A: In a study of the relationship between level education and income the following data was obtained. Find the relationship between them and comment.(20 marks)

Sample numbers	Level education	Income
A	Preparatory.	25
B	Primary.	10
C	University.	8
D	Secondary	10
E	Secondary	15
F	Illiterate	50
G	University.	60

Q4/B: What are the steps of statistical hypothesis? (5marks)

……GOOD LUCK……

Asst.Lect. RoaaJameel Abbas

Examiner

Percentage Points of the Chi-Square Distribution

Degrees of Freedom	Probability of a larger value of x^2								
	0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01
1	0.000	0.004	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.020	0.103	0.211	0.575	1.386	2.77	4.61	5.99	9.21
3	0.115	0.352	0.584	1.212	2.366	4.11	6.25	7.81	11.34
4	0.297	0.711	1.064	1.923	3.357	5.39	7.78	9.49	13.28
5	0.554	1.145	1.610	2.675	4.351	6.63	9.24	11.07	15.09
6	0.872	1.635	2.204	3.455	5.348	7.84	10.64	12.59	16.81
7	1.239	2.167	2.833	4.255	6.346	9.04	12.02	14.07	18.48
8	1.647	2.733	3.490	5.071	7.344	10.22	13.36	15.51	20.09
9	2.088	3.325	4.168	5.899	8.343	11.39	14.68	16.92	21.67
10	2.558	3.940	4.865	6.737	9.342	12.55	15.99	18.31	23.21
11	3.053	4.575	5.578	7.584	10.341	13.70	17.28	19.68	24.72
12	3.571	5.226	6.304	8.438	11.340	14.85	18.55	21.03	26.22
13	4.107	5.892	7.042	9.299	12.340	15.98	19.81	22.36	27.69
14	4.660	6.571	7.790	10.165	13.339	17.12	21.06	23.68	29.14
15	5.229	7.261	8.547	11.037	14.339	18.25	22.31	25.00	30.58
16	5.812	7.962	9.312	11.912	15.338	19.37	23.54	26.30	32.00
17	6.408	8.672	10.085	12.792	16.338	20.49	24.77	27.59	33.41
18	7.015	9.390	10.865	13.675	17.338	21.60	25.99	28.87	34.80
19	7.633	10.117	11.651	14.562	18.338	22.72	27.20	30.14	36.19
20	8.260	10.851	12.443	15.452	19.337	23.83	28.41	31.41	37.57
22	9.542	12.338	14.041	17.240	21.337	26.04	30.81	33.92	40.29
24	10.856	13.848	15.659	19.037	23.337	28.24	33.20	36.42	42.98
26	12.198	15.379	17.292	20.843	25.336	30.43	35.56	38.89	45.64
28	13.565	16.928	18.939	22.657	27.336	32.62	37.92	41.34	48.28
30	14.953	18.493	20.599	24.478	29.336	34.80	40.26	43.77	50.89
40	22.164	26.509	29.051	33.660	39.335	45.62	51.80	55.76	63.69
50	27.707	34.764	37.689	42.942	49.335	56.33	63.17	67.50	76.15
60	37.485	43.188	46.459	52.294	59.335	66.98	74.40	79.08	88.38

القسم : قسم هندسه تقنيات
المرحلة الثالثة
المادة : كهربائية طائرات
وقت الامتحان ساعتان
التاريخ : / ١ / ٢٠١٧

قسم تطران
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الكلية التقنية الهندسية نجف

First term examination 2016-2017

Note Answer all questions

Q1 --Enumerate the following , answer only four : (20)

1. The type of fire protection systems in A/C can be sub-divided into Specific areas of the A/C.
2. Examples of agents that do not deplete the ozone layer include.
3. Testing and inspections steps of altimeter system :
4. The precautions in testing pitot – static system .
5. 100- hours inspection of generator steps:

Q2- Sketch the following : (20)

1. Three phase transformer star-delta.
2. A pitot tube in aircraft .
3. Full – wave rectifier circuit.

Q3- Fill in the blanks with correct answers: (20)

1.----------is the type of wiring diagram that is of most importance To us as A/C maintenance technicions.
2. Solid wire may be used for the ----------where vibration is no Problem.
3. Wires that carry Ac or pulsating Dc are often ---------- .
4. The individual strands of wire are typically plated to protect ---------- from ---------- .
5. 12 V. Batteries may use either -------or-------cells, while 24 V. Are made up of --------or------ individual cells.

Q4- A-What is the alternator?

B-Mention alternator's type depending on:

1-type of excitation.

2-type of rotating-field.

C-Why the power of alternator express in KVA not in Watt?

D-If the speed of alternator 3600 $_{RPM}$ and have a two-pole calculate the frequency of it?

Q5 A/Answer the following: (20)

1-The advantage of digital system on aircraft system.

2-The units of CPU in computer for aircraft system.

3-Types of DC motor depending on (type of duty).

4-The different between RAM and ROM.

5-The type of modulation and which is the better?

B/Define (only five) (20)

Power factor, coaxial cable, space wave, rectifier, LRU,sky wave

رئيس القسم
د. اسعد عواد

مدرس المادة
محمد علي كريم / فرقان كامل

قسم الطيران
٣/ب

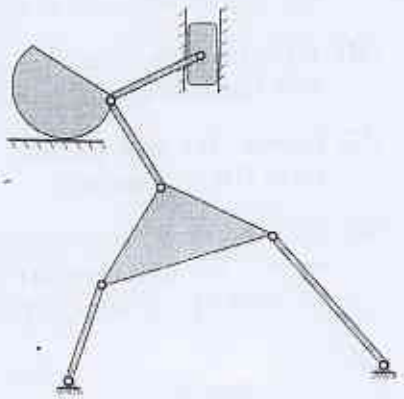
Ministry of Higher Education & Scientific Research
Al-Furat Al-Awsat Technical University
Engineering Technical College- Najaf
Department of Aeronautical Eng. Tech.

Class Level: 3rd year
Instructor: Dr. Assaad Al-Sahlani

Mid-term 1 / 2016-2017

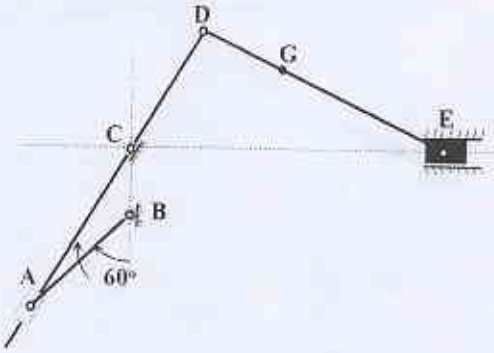
Course Title: Theory of Machines
Time: 2 hours

Q1: For the system of links shown, the shaded areas are solid links. The circles represent rotating joints. Be sure to show your work to find:



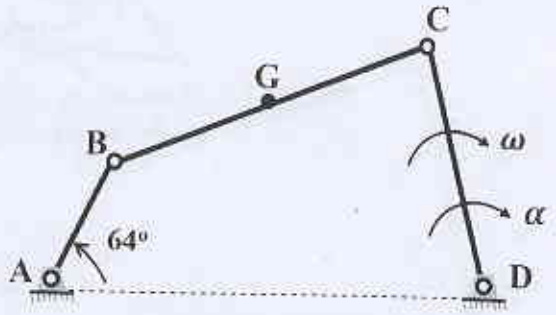
1. Number of links. **(8 points)**
2. Number of joints. **(8 points)** and
3. DOF of the system and clarify the nature of the system (Mechanism, structure or pre-loaded structure) **(4 points)**

Q2: For the mechanism shown



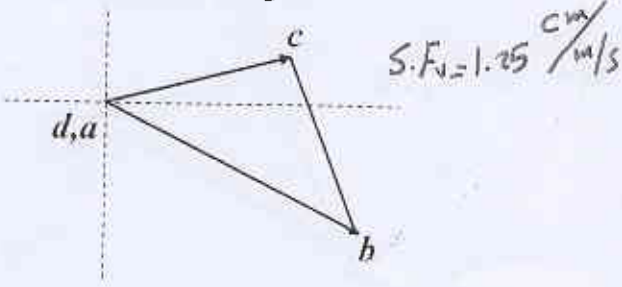
1. Accurately redraw the mechanism with scale factor of ($S.F_p$= 0.02 cm/mm). The distance between the fixed centers is CB=100 *mm*, crank AB = 200 *mm*; CD = 200 *mm* and the link DE = 400 *mm* with its center of gravity G, 100 *mm* from D. **(15 points)**
2. If crank AB rotates at 4 rad/s clockwise, draw graphically the velocity diagram, and **(10 points)**
3. Find the **magnitude** and **direction** of **(a)** velocity of point G, and **(b)** the angular velocity of link DE.**(5 points)**

Q3: In the four bar mechanism shown, the velocity diagram is obtained along with the position diagram , the distance between the fixed centers is AD=90 *mm*, crank AB = 30 *mm*; BC = 70 *mm* and CD = 50 *mm*.



Position diagram

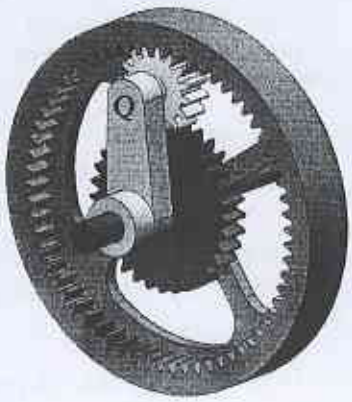
1. If ω= 40 rad/s and α= 0, use the velocity diagram (drawn with scale factor of $S.F_v$ = 1.25) shown to graphically represent the acceleration diagram of the mechanism. **(15 points)**
2. Find the **magnitude** and **direction** of the acceleration of point **G**. **(8 points)**
3. Find the **magnitude** and **direction** of angular accelerations of links AB and BC. Which one is deceleration? **(7 points)**



Velocity diagram

Next page please.....

Q1: For the planetary gears shown, the number of teeth for the ring gear is twice the number of teeth of sun gear ($N_R = 2N_S$), also the number of teeth for the sun gear is twice the number of teeth for planet gear ($N_S = 2N_P$)



(A) Establish the table that links the relationships between the angular velocities of gears and arm. **(5 points)**

(B) If the sun gear is fixed (ω_s=0) and the ring gear rotates with (ω_r=100 r.p.m CW), find ω_{arm}. **(5 points)**

(C) Repeat **(B)** with (ω_s=100 r.p.m CCW) and (ω_r=100 r.p.m CW). **(5 points)**

(D) Let point **Q** represents the center of the planet gear (end of arm), in which case **(B)** or **(C)**, the linear velocity of the point **Q** is greater? Why? **(5 points)**

Good Luck!

Cordially !

Instructor & Head of Dept.
Dr. Assaad Al Sahlani

قسم الطيران
٣/ب

المادة: Gas Dynamic
المرحلة :الثالثة
مدرس المادة :م.م. بسام عبد الصا

وزارة التعليم العالي والبحث العلمي
جامعة الفرات الاوسط التقنية
الكلية التقنية الهندسة النجف

الامتحان الفصل الاول للعام الدراسي2016-2017

Answer all question

Q1: Derive the following relation for one dimensional isentropic *20M*

1- $\frac{dA}{A} = \frac{dP}{\rho v^2}(1 - M^2)$

2- $\frac{P^*}{P} = \left(\frac{2}{\gamma+1} + \frac{\gamma-1}{\gamma+1}M^2\right)^{\frac{\gamma}{(\gamma-1)}}$

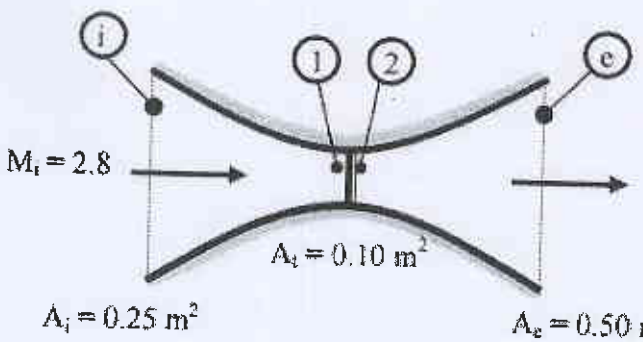
Q2: A) A convergent divergent air nozzle has an area ratio $A/A^*=1.436$. calculate the Mach and pressure ratio (P/P_o) for isentropic flow taking $\gamma=1.3$. Recalculate the above values in the subsonic of the nozzle for the same area ratio. *10M*

B) what the variation (decrease and increase) of flow parameters (area, pressure, velocity) in convergent –divergent nozzle and diffuser with (M<1, M=1and M>1). 10M

Q3: A supersonic nozzle expand air from P_o =25 bar and T_o=1050 K to an exit pressure of 4.35 bar; the exit area of the nozzle is 100 cm^2. Determine (a) throat area; (b) pressure and temperature at the throat; (c) temperature at exit (d) mass flow rate. *20M*

Q4: A converging-diverging nozzle with an area ratio (exit to throat) of 3.0 exhausts air (γ = 1.4) from a large high-pressure reservoir to a region of back pressure p_b. Under a certain operating condition, a normal shock is observed in the nozzle at an area equal to 2.2 times the throat area. What percent of decrease in back pressure would be necessary to rid the nozzle of the normal shock? *20M*

Q5: Air (γ = 1.4) enters a converging-diverging diffuser with a Mach number of 2.8, static pressure p_i of 100 k Pa, and a static temperature of 20°C. For the flow situation shown in Figure below, find the exit velocity, exit static pressure, and exit stagnation pressure



20M

مدرس المادة

قسم الطيران
٣/٥

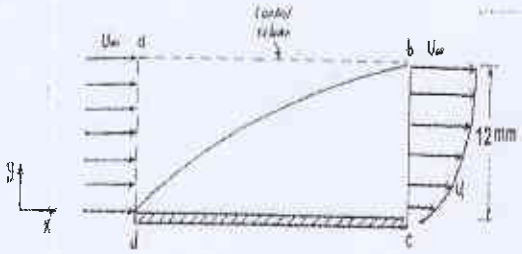
وزارة التعليم العالي و البحث العلمي	المرحلة: الثالثة
جامعة الفرات الاوسط التقنية	المادة: ديناميك الهواء
الكلية التقنية الهندسية النجف	الزمن: ساعتان
قسم هندسة تقنيات الطيران	الممتحن: د. حيدر حسن عبد

Q1)Discuss with sketches the boundary layer separation. (20 degree)

Q2) Two parallel plates are spaced 4 mm apart, and oil (μ = 0.1 N.s/m2 , S = 0.8) flows at a rate of 24×10^{-3} m^3/s per m of width between the plates. What is the pressure gradient in the direction of flow if the plates are inclined at 25 ° and 75° with the horizontal and if the flow is downward between the plates? (20 degree)

Q3) A layer of viscous liquid of thickness b flows steadily down an inclined plane. Show that, by using the Navier-Stokes equations that velocity distribution is:$u = \frac{\gamma}{2\mu}(2by - y^2)sin\theta$ and that the discharge per unit width is: $Q = \frac{\gamma}{3\mu}b^3 sin\theta$ (20 degree)

Q4) Air (ρ = 1.21 kg/m3) flows over a thin flat plate 2.5 m long and 0.3 m wide. The flow is uniform at the leading edge of the plate. while the velocity profile of the boundary layer is shown in figure, and the free stream velocity is 3.7 m/s. Using control volume (abcd) shown in figure, compute the mass flow rate across surface (ab) and (bc). Determine the magnitude and direction of the x component of the force required to hold the plate stationary. (20 degree)



Q5) define five of the following: 1. Sliding bearing 2. Boundary layer 3. Displacement thickness 4. Shape factor 5. Bluff body 6. Pressure drag 7. Stream line body (20 degree)

Navier-Stokes

$$\rho\left[\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} + w\frac{\partial u}{\partial z}\right] = \rho g_x - \frac{\partial p}{\partial x} + \mu\left[\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right]$$

DR. HYDER HASSAN

GOOD LUCK