Sem-V / Heat Transfer / MECH / 11-12-15

QP Code : 5722

(3 Hours) [Total Marks: 80

Instructions:
1) Question No-1 is compulsory
2) Answer any 3 from the remaining.
3) Assume suitable data if necessary.

Q-1 Answer **ANY FOUR** Questions. [20]

a) Two pin fins are identical except that the diameter of one is twice of other. For which fin will (i) Fin Effectiveness (ii) Fin Efficiency be higher?

b) What is Thermal Boundary Layer.?Illustrate the same with the help of a neat diagram.

c) What is fouling in Heat Exchangers?

d) During the ripening process of orange, the average heat energy release is estimated as 4715 KJ/ m^3hr. If the orange is assumed to be homogenous sphere having K=0.175 W/mK, compute the temperature at centre of orange.

e) A Filament of a 75 W light bulb may be considered as a black body radiating into a black enclosure of 70°C.The filament diameter is 0.1 mm and length 50mm.Considering the radiation , determine the filament temperature.

Q-2 a) A standard cast iron pipe (inner diameter = 50 mm and outer diameter = 55 mm) is insulated with magnesium insulation (k = 0.02 W/mK). Temperature at the interface between the pipe and insulation is 300°C. The allowable heat loss through the pipe is 600 W/m length of pipe for the safety; the temperature of the outside surface of insulation must not exceed 100 °C. Determine minimum thickness of insulation required. [08]

b) Derive a relation of heat transfer through fin with heat loosing at tip [8]

c) Define thermal conductivity. How thermal conductivity is varied with temperature? [4]

Q-3 a) Air at 200°C and at atmospheric pressure flows at a velocity of 2 m/s over a plate maintained at 1000°C . The length and width of the plate are 800mm and 400mm resp. Using exact solution; calculate the heat transfer rate from. [10]

i) First half of the plate ii) Full plate and iii) Next half of the plate.
$Nu = 0.332\ Re^{0.5}\ Pr^{0.333}$ Properties of air at 600°C are $\rho = 1.06$ kg/ m^3, $\mu = 7.211$kg/mh, $\nu = 18.97 \times 10^{-6}$ m^2/s, Pr=0.696

b) With the help of Buckingham π-theorem show that for forced convection $Nu = C\ Re^m\ Pr^n$. [10]

Q-4 a) Show that the radiant heat transfer between two infinitely large parallel plates separated by n shields is [8]

$$Q_{n-shields} = \frac{A\,\sigma\,(T_1^4 - T_2^4)}{(n+1)[\frac{2}{\epsilon} - 1]}$$

b) The net radiation from the surfaces of two parallel plates maintained at temperature T_1 and T_2 is to be reduced by 79 times. Calculate the number of screens to be placed between the two surfaces to achieve this reduction in heat exchange. Assuming the emissivity of screens as 0.05 and that of the surfaces as 0.8. [8]

[TURN OVER

c) What is the mode of heat transfer in vacuum? Define Absoptivity, Reflectivity, Transmisivity and establish the relation among them. [4]

Q-5 a) Derive the expression for log mean temperature difference (LMTD) in a parallel flow heat exchanger. State your assumptions. [8]

b) A counter flow heat exchanger is employed to cool 0.55 kg/s (Cp = 2.45 kJ/kg^{0}C) of oil from 115^{0}C to 40^{0}C by the use of water. The inlet and outlet temperature of cooling water are 15^{0}C and 75^{0}C respectively. The overall heat transfer coefficient is expected to be 1450 W/m^2 ^{0}C. Using NTU method. Calculate the following: [8]

i) The mass flow rate of water
ii) The effectiveness of the heat exchanger
iii) The surface area required.

c) Classify Heat Exchangers on various arrangements. [4]

Q-6 a) Answer (any Two) [8]

(i) What is Filmwise and Dropwise condensation?
(ii) Why Extended surface are used?
(iii)How Numerical methods are used in conduction heat transfer.

b) An egg with mean diameter of 4cm and initially at 20^{0}C is placed in a boiling water pan for 4 min and found to be boiled to the consumers taste. For how long should a similar egg for same consumer be boiled when taken from refrigerator at 5^{0}C? Take the following properties for egg: k = 10 W/mK, ρ = 1200 kg /m^3, C_p = 2 kJ/kg K and h = 100W/m^{2}K. Use lump theory. [8]

c) Explain the physical significance of Reynold number and Prandtl number [4]

Course: T.E. (SEM-V) (REV-2012) (CBSGS) (MECH ENGG) C.W. (AUTO ENGG.) (T3525 CW T2225)

Q. P. Code: 5722

Correction:

Q.1 d) Take diameter of orange = 90mm

Outer surface temperature of orange = 8^0 C.

Q.2 a) K for cast iron = 20 W/m° C.

Q.3 a) K for air 0.02894 W/m° C.

Query Update time: 11/12/2015 03:30 PM

MECH CBGS

TE/V/MECH/IC Engineering / 01.12.15

QP Code: **5638**

(3 Hours) [Total Marks :80]

Instructions:

1) Question No-1 is compulsory
2) Answer any 3 from the remaining.
3) Assume suitable data if necessary.

Q1 **Attempt any five of the following** (20)

a) Justify - Variation in specific heats is responsible for changes in efficiency of air standard efficiency of engine.

b) Justify - Progressive increase in richness of air fuel mixture is disadvantage of simple carburettor

c) Justify - While designing SI engine combustion chamber surface to volume ratio should be kept maximum for end gas region

d) Explain how the quantity of fuel to be injected inside combustion chamber of diesel engine is controlled with fuel injection pump?

e) Justify - Lower values of compression ratios are preferred for turbocharged engine

f) Explain how it is possible to lower down NOX emissions from engine with exhaust gas recirculation method?

Q2a) During trial on single cylinder, four stroke oil engine, the following observations were recorded:

Bore and stroke : 300 mm x 450 mm
Duration of trial : 60 min
Engine speed : 220 RPM
Fuel consumption : 7 kg
Calorific value of fuel : 45000 kJ/kg
Indicated mean effective pressure : 5.867 bar
Net brake load : 130 kg
Brake drum diameter : 1650 mm
Total weight of jacketed cooling water : 500 kg
Temperature rise of jacketed cooling water : 40 degree centigrade
Temperature of exhaust gases : 300 degree centigrade
Air consumption : 300 kg
Specific heat of exhaust gases : 1.004 kJ/kgoK
Room temperature : 25°C
Determine: Mechanical efficiency, Indicated and Brake Thermal efficiency and heat balance sheet on minute and percentage basis. (12)

b) Write a note on effects of detonation. (08)

(TURN OVER)

Q3 a) A four cylinder four stroke engine has a cubic capacity of 1490 cm^3. It develops maximum power at 4200 RPM and air fuel ratio required is 13:1. The air speed at venturi is limited to 90 m/s. The volumetric efficiency of engine is 70%. Nozzle lip is 6 mm and atmospheric pressure and temperatures are 1.013 bar and 293 K. An allowance is to be made for emulsion tube whose diameter should be taken as 1/2.5 of venture diameter. Taking following data, calculate the diameter of venture and nozzle.

Cda = 0.85, Cdf = 0.66 and density of fuel = 740 kg/m3 (10)

b) What are the requirements of diesel fuel injection system? Explain air injection system with neat sketch. (10)

Q4 a) In an Otto engine pressure and temperature at the beginning of compression are 1 bar and 37°C respectively. Calculate the theoretical thermal efficiency of the cycle, if the pressure at the end of adiabatic compression is 15 bar. Peak temperature during the cycle is 2000 K. Calculate the heat supplied per kg of air, work done per kg of air and the pressure at the end of adiabatic expansion. Take Cv = 0.717 kJ/kg°K and adiabatic index = 1.4. (10)

b) With neat sketch explain various types of fuel nozzles used in diesel fuel injection system. (10)

Q5 a) What are the effects of engine under cooling and over cooling? With neat sketch explain principal and working of evaporative cooling system. (12)

b) What are the interpretations drawn from percentages of HC, CO, CO2 and O2 from engine exhaust? (08)

Q6 **Write a short note on (any four)** (20)

a) Octane rating of fuel and its determination
b) Comparison between dry sump and wet sump lubrication system
c) Effect of supercharging on thermodynamic cycle
d) SI engine fuel injection systems
e) Stages of combustion in CI engine
f) Stratified charge engine

T.E / V / MECH / Mech. Measu. & Control.

MECH

24/11/2015

QP Code : 5597

(3 Hours) CBGS. **[Total Marks : 80**

N.B.:
(1) **Question No.1 is compulsory**
(2) Attempt any **three**questionsout of remaining **five** questions
(3) Figures to right indicate full marks
(4) Assume suitable data if **necessary**.
(5) Notations carry usual meaning.

Q.1(A) Explain generalized measurement system elements with block diagram. 05

(B) Write the different classification of control systems. 05

(C) Write short note on PI controller. 05

(D) Write the working principle of piezoelectric accelerometer 05

Q.2(A) Explain the following terms with respect to the measurement system: (i) Span and Range (ii) Hysteresis 06

(B) Illustrate the working principle of "LVDT" for displacement measurement. 06

(C) Convert the following state-space system of a single input single output system into a transfer function: 08

$$\begin{Bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{Bmatrix} = \begin{bmatrix} -3 & 2 \\ 1 & 1 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix} + \begin{Bmatrix} 0 \\ 2 \end{Bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix}.$$

Here x_1 and x_2 are state-variables, u (t) is a force vector and y (t) being the system response.

Q.3(A) With a neat sketch explain working of an Operational Amplifier (Op-amp). Enumerate limitations of the same. 05

(B) What are desired, interfering and modifying inputs w.r.t. measurement of a system? 05

[TURN OVER

MD-Con. 8232-15.

(C) A unity feedback system has $G(s) = \frac{k}{s(1+s)(1+0.4s)}$, (a) If r (t) = 4t and k= 2, find steady state error (b) If it is desired to have steady state error to be 0.2 find corresponding value of "k". (c) Find steady state error if input is changed to 2+6t , and value of "k" to 10. 10

Q.4(A) What are rosettes? Explain different types and configuration of rosettes. 10

(B) The open loop T.F. of unity feedback system is $G(s) = \frac{K}{S(1+TS)}$, for this system overshoot reduces form 0.6 to 0.2 due to change in "K" only. Show that $\frac{TK_1 - 1}{TK_2 - 1} = 43.33$, where K_1 and K_2 are values of "K" for 0.6 and 0. 2 overshoot respectively 10

Q.5(A) Sketch Bode plot and assess the stability for the control system having open loop transfer function 10

$$G(S)H(S) = \frac{120}{(S+2)(S+10)}$$

(B) With a neat sketch explain the constructional feature and working of (i) Ionization Gauge, (ii) Thermistors 10

Q.6(A) Draw the root-locus of the control system whose open-loop transfer function is given by

$$G(S)H(S) = \frac{K}{S^2(S+1)}$$ 10

(B) With a neat sketch explain the constructional feature and working of (i) digital tachometer, (ii) Electromagnetic flow meter 10

TE/V/ Production Process / MECH / 7.12.15

III

QP Code : 5681

Duration 3Hrs | Max. Marks: 100

Instructions:

(1) Question No.1 is compulsory and Answer 3 Questions remaining 5 Questions.
(2) Assume suitable data wherever necessary
(3) Concepts explanation with suitable case study justification
(4) Diagram and sketches explanations are right to reserve full marks

Q1	**Answer Any Four Questions**	
	1. Integration of process and Product development system	20
	2. Classification of various press tool machines with line sketches	
	3. Write short note on Ultra Sonic Machining **(USM)**	
	4. Explain Scrap strip Layout	
	5. Define Jigs and Fixtures	
Q2	1. Explain Transfer machine machines used in industry?	10
	2. Explain various sheet metals production process with neat sketches.	10
Q3	1. Explain the following with neat sketches i, Locators ii) Clamping Devices (Any Two Each)	10
	2. Explain the general arrangement of Injection plastic molding process	10
Q4	1. Tabulate classification of non-traditional manufacturing processes & Explain Electron Beam Machining (EBM)	10
	2. Explain Flexible Manufacturing System (FMS)	10
Q5	1. Explain principle, construction, working, applications, advantageous and limitations of Abrasive Jet Machining (AJM)	10
	2. Draw an economical strip layout and find out percentage utilization of material of square product. Thickness of sheet metal 1 mm (Assume side of the product is 25mm)	10
Q6	**Answer Any Two Questions**	20
	1. Explain principle, construction, working, applications, advantageous and limitations of Electro chemical Machining **(ECM)**	
	2. Agile Manufacturing System principles, procedures, implementation in Production Process	
	3. Write short note on (i) Die and Punch of press tool design with neat sketches (ii) 3-2-1 Principle of Locators with neat sketches	

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MD-Con. 10162-15.

IE/V/ Theory of Machines - II /MECH (CBGS)
18/11/15

QP Code: **5555**

(3 Hours) [Total Marks ; 80]

N.B. : (1) Question No. 1 is **Compulsory**

(2) Answer any **three** questions from remaining **five** questions

(3) Assume suitable data whenever required but justify the same

(4) Answer to the questions showed be grouped and written together.

1. Answer any **four** questions (20)

(a) What do you understand by dry clutch and wet clutch?

(b) Define dynamically equivalent system. State the condition is necessary to make two systems dynamically equivalent.

(c) Explain the necessity of gear box in automobile.

(d) Explain the following terms with reference to a governor-

(i)Sensitiveness (ii) stability (iii) Isocronism (iv) Coefficient of insensitiveness

(e) What do you understand by gyroscopic couple? Derive a formula for its magnitude.

2 (a) A cone clutch with a semi-cone angle of 15^0 transmits 10kW at 600rpm. The normal pressure intensity between the surfaces in contact is not to exceed 100 kN/m^2. The width of the friction surfaces is half of the mean diameter. Assume $\mu = 0.25$. Determine (i) the outer and inner diameter of the plate. (ii) width of the cone face. (iii) the axial force to engage the clutch. (10)

(b) In the epicyclic gear train shown in Fig. 1. The compound wheels A and B as well as internal wheels C and D rotate independently about the axis O. The wheels E and F rotate on the pins fixed to the arm 'a'. All the wheels are of the same module. The number of teeths on the wheels are

$$T_A = 52,\ T_B = 56,\ T_E = T_F = 36$$

Determine the speed of C, if (i) the wheel D fixed and arm 'a' rotates at 200 rpm clockwise (ii) the wheel D rotates at 20 rpm counter -- clockwise and arm 'a' rotates at 200 rpm clockwise. (10)

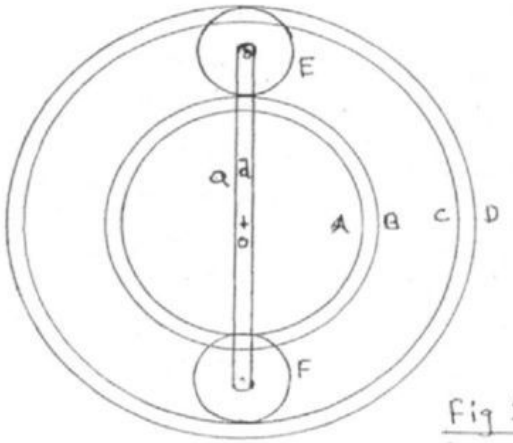

Fig 1

TURN OVER

3 (a) A horizontal gas engine running at 210 rpm has a bore of 220 mm and a stroke of 440 mm. The connecting rod is 924 mm long and the reciprocating parts weigh 20 kg. when the crank has turned through an angle of 30^0 from the inner dead center, the gas pressures on the cover and the crank sides are 500 kN/m^2 and 60 kN/m^2 respectively. Diameter of the piston is 40mm. Determine (i) turning moment on the crank shaft. (ii) thrust on the bearings. (iii) acceleration of the flywheel which has a mass of 8 kg and radius of gyration of 600 mm while the power of engine is 22 kW. (08)

(b) In a spring –loaded Hartnell type of governor, the mass of each ball is 4 kg and lift of the sleeve is 40 mm. The governor begins to float at 200 rpm when the radius of the ball path is 90 mm. The mean working speed of the governor is 16 times the range of speed when friction is neglected. The lengths of the ball and roller arms of the bell crank lever are 100 mm and 80 mm respectively. The pivot centre and axis of the governor are 115 mm apart. Determine the initial compression of the spring, taking into account the obliquity of arms.

Assuming the friction at the sleeve to be equivalent to a force of 15 N, determine the total alteration in speed before the sleeve begins to move from the mid-position. (12)

4 (a) Each wheel of a motorcycle is of 600 mm diameter and has a moment of inertia of 1.2 kg-m^2. The total mass of the motorcycle and the rider is 180 kg and combined centre of mass is 580 mm above the ground level when the motor cycle is upright. The moment of inertia of the rotating parts of the engine is 0.2 kg-m^2. The engine speed is 5 times the speed of the wheels and is in the same sense. Determine the angle of heel necessary when the motor cycle takes a turn of 35 m radius at a speed of 54km/h. (10)

(b) Single plate clutch transmits 25 kW at 900rpm. The maximum pressure intensity between the plates is 85 kN/m^2. The outer diameter of the plate is 360 mm. Both the sides of the plate are effective and the coefficient of friction is 0.25. Determine (i) inner diameter of the plate, and (ii) axial force to engage the clutch. (10)

5 (a) A differential band brake, as shown in Fig. 2 has an angle of contact of 225^0. The band has a compressed woven lining and bears against a cast iron drum of 350 mm diameter. The brake is to sustain a torque of 350 N-m and the coefficient of friction between the band and drum is 0.30. Find: (a) The necessary force (F) for the clockwise and anticlockwise rotation of the drum; and (b) The value of 'OA' for the brake to be self locking , when the drum rotates clockwise. (12)

TURN OVER

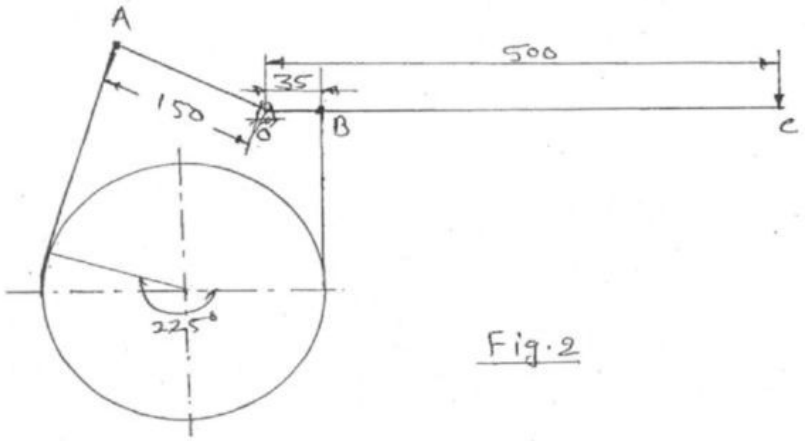

Fig.2

(b) A cast iron flywheel is requires to absorb 25000 N-m of energy as speed is increased from 120 to 125 rpm. If the wheel is to be solid disc having a diameter 8 times its thickness. Determine its diameter. Density of C.I. = 7200 kg/m^3. (08)

6 (a) A loaded porter governor has 4 links each 25 cm long, 2 revolving masses each weighing 30 N and a central dead weight weighing 200 N. All the links are attached to respective sleeves at radial distances of 4 cm from the axis of rotation. The masses revolve at a radius of 15 cm at minimum speed and at a radius of 20 cm at maximum speed. Determine the range of speed. (10)

(b) The turbine rotor of ship has a mass of 900 kg and radius of gyration 600 mm. It rotates at 1800 rpm clockwise looking from the stern. Determine gyroscopic couple and its effect when; (i) the ship is travelling at 40 km/hr and steers to left in a curve of 100 m radius; (ii) the ship is pitching and the bow is descending with maximum velocity. The pitching is simple harmonic, the periodic time being 30 seconds and total angular moment between the extreme positions is 12^0. (10)