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06MAT41

Fourth Semester B.E. Degree Examination, June-July 2009
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Solve $\frac{dy}{dx} = 2y + 3e^{x}$, $y(0) = 0$. Using Taylor's series method an find y(0.1), y(0.2). **(06 Marks)**

b. Use Runge-Kutta method of fourth order to solve $\frac{dy}{dx} = x + y$, $y(0) = 1$ at $x = 0.2$ with step length $h = 0.2$. **(07 Marks)**

c. Use Milne's predictor –corrector method to find y at x = 0.8, given $\frac{dy}{dx} = x - y^2$ with,

X	0	0.2	0.4	0.6
Y	0	0.02	0.0795	0.1762

Apply corrector once. **(07 Marks)**

2 a. Find the analytic function f(2) = u + iv if $v = e^{x}(x \sin y + y \cos y)$. **(06 Marks)**

b. Find the image of lines parallel to x – axis and lines parallel to y – axis under the transformation $w = z^2$. Draw neat sketch. **(07 Marks)**

c. Find the bilinear transformation that maps the points z = -1, j, 1 on to the points w = 1, j, -1. **(07 Marks)**

3 a. If f(z) is analytic within and on a simple closed curve C and 'a' is a point within 'C' then prove that $f(a) = \frac{1}{2\pi j}\int_c \frac{f(z)}{z-a}dz$. **(06 Marks)**

b. State Cauchy's residue theorem. Hence or otherwise evaluate –

$\int_c \frac{e^{2z}}{(z+2)(z+4)(z+7)}dz$ for 'C' as $|Z| = 3$. **(07 Marks)**

c. Find the Taylor's series expansion of $f(z) = \frac{1}{(z+1)^2}$ about the point z = -i. **(07 Marks)**

4 a. Prove that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}}\sin x$. **(06 Marks)**

b. Express polynomial $2x^3 - x^2 - 3x + 2$ in terms of Legendre polynomials. **(07 Marks)**

c. Compute P_0, P_1, P_2, P_3, P_4 using Rodrigue's formula. **(07 Marks)**

PART – B

5 a. Fit a parabola $y = a + bx + cx^2$, given the data : **(06 Marks)**

x	– 3	– 2	– 1	0	1	2	3
y	4.63	2.11	0.67	0.09	0.63	2.15	4.58

b. Obtain the coefficient of correlation and the liens of regression if : **(07 Marks)**

x	1	3	4	2	5	8	9	10	13	15
y	8	6	10	8	12	16	16	10	32	32

c. A tea set has four sets of cups and saucers. Two of these sets are of one colour and the other two sets are of different colours. (totally three colours). If the cups are placed randomly on saucers, what is the probability that no cup is on a saucer of same colour. **(07 Marks)**

6 a. Define i) Random variable ii) Discrete probability distribution with an example. **(06 Marks)**

b. The probability that a man aged 60 will live up to 70 is 0.65. What is the probability that out of 10 men, now aged 60, i) exactly 9, ii) at the most 9 iii) at least 7, will live up to the age of 70 years. **(07 Marks)**

c. In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation, given that A(0.5) = 0.19 and A(1.4) = 0.42. **(07 Marks)**

7 a. Find the probability that in 100 tosses of a fair coin between 45% and 55% of the outcomes are heads. **(06 Marks)**

b. A mechanist is making engine parts with axle diameter of 0.7 inches. A random sample of 10 parts showed a mean of 0.472 inches with a standard deviation of 0.04 inches. On the basis of this sample, can it be concluded that the work is inferior at 5% level of significance. **(07 Marks)**

c. For the following data test the hypothesis that the accidents are uniformly distributed over all the days of the week for 99% confidence.

Day	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total
No. of accidents	14	16	8	12	11	9	14	84

(07 Marks)

8 a. Find the –
Marginal distribution of x
Marginal distribution of y
Cov (x, y) if the joint pdf of x and y is

x \ y	1	3	9
2	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$
4	$\frac{1}{4}$	$\frac{1}{4}$	0
6	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$

(06 Marks)

b. Find the fixed probability vector of regular stochastic matrix

$$A = \begin{bmatrix} 0.5 & 0.25 & 0.25 \\ 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \end{bmatrix}.$$

(07 Marks)

c. A company executive changes his car every year. If he has a car of make A, he changes over to make B. from make B he changes over to make C. if he has car 'C' then he gives equal preference to change over to make A or make B car. If he had a car of make C in year 2008 find the probability that he will have a car of i) make A in 2010, ii) make 'C' in 2010. **(07 Marks)**

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06ME43

Fourth Semester B.E. Degree Examination, June-July 2009
Applied Thermodynamics

Time: 3 hrs. Max. Marks:100

Note : ***1. Answer any FIVE full questions, choosing at least TWO questions form each part.***
2. Thermodynamics data book allowed.

PART – A

1 a. Define i) Enthalpy of formation ii) Enthalpy of combustion iii) Stochiometric air iv) Excess air and v) Adiabatic flame temperature. **(10 Marks)**

b. Coal with following mass analysis is burnt with 100% excess air. C = 74%, H_2 = 4.3%, S = 2.7%, N_2 = 1.5%, H_2O = 5.5%, O_2 = 5%, Ash = 7%. Find moles of gaseous products if 100kg of fuel are burnt. **(10 Marks)**

2 a. Compare Otto and Diesel cycles, with the help of PV and T-S diagrams, based on the following conditions. i) When maximum cycle pressure and temperature are same. ii) When compression ratio and heat addition are same. **(08 Marks)**

b. The following data refers to an ideal sterling cycle with ideal regenerator. Pressure, temperature and volume of the working medium at the beginning of the isothermal compression are 100kPa, 30^0C and 0.05m^3 respectively. The clearance volume of the cycle is 1/10 of the initial volume. The maximum temperature attained in the cycle is 700^0C. Draw PV and T-S diagrams. Calculate i) The net work ii) Thermal efficiency with 100% regenerator efficiency iii) Thermal efficiency without the regenerator. **(12 Marks)**

3 a. Draw neat line diagram and T-S diagram for the following G.T. cycle.
i) Regeneration ii) Intercooling iii) Reheating. **(12 Marks)**

b. Air enters the compressor of an ideal air standard Brayton cycle at 100kPa, 300K with a volumetric flow rate of 6m^3/S. The compressor pressure ratio is 10. The turbine inlet temperature is 1500K. Determine i) The thermal efficiency ii) work ratio iii) The power developed. **(08 Marks)**

4 a. Draw neat line diagram and T-S diagram for the following vapour power cycle.
i) Practical regenerative Rankine cycle with closed feed water heaters.
ii) Practical regenerative Rankine cycle with open feed water heaters. **(08 Marks)**

b. Steam from a boiler enters a turbine at 25bar and expands to condenser pressure of 0.2 bar. Determine the Rankine cycle efficiency neglecting pump work ;
i) When steam is 80% dry at turbine inlet.
ii) When steam is saturated at turbine inlet.
iii) When steam is superheated at turbine inlet by 76.1^0C.
iv) Represent above 3 processes on same T-S diagram.

Pressure bar	h_f kJ/kg	h_g kJ/kg	s_f kJ/kg.K	s_g kJ/kg.K
25	962.0	2800.9	2.5543	6.2536
0.2	251.5	2609.9	0.8321	7.9094

Ts at 25 bar = 223.9^0C ; h_{sup} at 25 bar, 300^0C = 3008.8kJ/kg ;
S_{sup} at 25 bar, 300^0C = 6.644 kJ/kg K. **(12 Marks)**

PART – B

5 a. Derive an expression for work done in a reciprocating air compressor, i) without clearance ii) with clearance. **(06 Marks)**

b. What is the purpose of multistaging in reciprocating compressor? How does it affect i) Mechanical efficiency ii) Volumetric efficiency? **(06 Marks)**

c. A single cylinder, double acting air compressor is required to deliver 100 m^3/min of air at a mean piston speed of 500m/min measured at 1 bar and 15^0C. The air is delivered at 7 bar. Assume a clearance volume of $1/15^{th}$ of swept volume per stroke. Find volumetric efficiency, speed, bore, stroke for the following two cases.
i) if ambient and suction conditions are same.
ii) if ambient and suction conditions are different.
Ambient pr. = 1.0 bar, Ambient temp. = 15^0C , Suction pr. = 0.98 bar, Suction temp = 30^0C. Assume L/D = 1.25. **(08 Marks)**

6 a. Draw neat PV and TS diagram for reversed Brayton cycle. **(02 Marks)**

b. Show that COP reversed Brayton cycle = $\dfrac{1}{\left[R_P^{\frac{\gamma-1}{\gamma}} - 1\right]}$

R_P = Pressure ratio ; $\gamma = C_p / C_v$ = remains same during expansion and compression process. **(04 Marks)**

c. A simple NH_3 vapour compression system has a condenser temperature of 30^0C and evaporator temperature of -15^0C. The liquid is subcooled by 10^0C. Calculate
i) Refrigerating effect ii) Mass flow rate per ton of refrigeration iii) COP
iv) Power per TR v) Represent on pH and TS diagram.
$Cp_{(vap)}$ = 2.805 kJ/kg K , $Cp_{(liq)}$ = 4.606 kJ/kg K. **(14 Marks)**

Properties of NH_3.

Temp	Enthalpy kJ/kg		Entropy kJ/kg K		SP. Vol. m^3/kg
	h_f	h_g	s_f	s_g	v_g
- 15	112.3	1426.0	0.457	5.549	0.509
+ 30	323.1	1469.0	1.204	4.984	

7 a. Define i) Specific humidity ii) degree of saturation iii) relative humidity. **(06 Marks)**

b. Moist air at 35^0C has a dew point of 15^0C. Calculate its relative humidity, specific humidity and enthalpy. Take Cp_v = 1.88 kJ/kg K. **(06 Marks)**

c. 30 m^3/min of air at 15^0C DBT and 13^0C WBT is mixed with 12 m^3/min of air at 25^0C DBT and 18^0C WBT. Calculate DBT, specific humidity of the mixture. Take atm. pressure as 760 mm of Hg. Calculate by calculation method only. **(08 Marks)**

8 a. Explain briefly the Morse test. **(06 Marks)**

b. A 4 cylinder engine has the following data :
Bore = 15cm, stroke = 15cm, Piston speed = 510m/min, BP = 60 kW, Mech. Efficiency 80%, Mep = 5bar, CV = 40000 kJ/kg. Calculate i) whether this is a two stroke OR 4 stroke cycle engine. **(04 Marks)**

c. Following data are available for SI engine, single cylinder stroke = 4, A:F = 16:1, CV = 45000 kJ/kg, mech, η = 80% , Air std, η = 50%, relative η = 70%, stroke to bore = 1.5, suction condition = 1 bar, 30^0C, speed = 2500 rpm, BP = 75 kW. Calculate
i) compression ratio, ii) indicated thermal η , iii) BSFC , iv) Brake thermal η , v) Bore and stroke : Assume volume η = 80%. **(10 Marks)**

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06ME44

Fourth Semester B.E. Degree Examination, June-July 2009
Kinematics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions selecting at least two from each part.***

PART – A

1 a. What do you mean by inversion? What is its importance? **(04 Marks)**

b. Draw a neat figure of slider-crank mechanism and identify various pairs in it and explain them. **(06 Marks)**

c. Describe with neat figures two inversions of double slider-crank chain. **(10 Marks)**

2 a. What are quick return mechanisms? Where are they used? Sketch and explain the functioning of any one of them. **(10 Marks)**

b. Derive an expression for necessary condition of correct steering and explain Ackermann steering gear with neat sketch. **(10 Marks)**

3 a. Explain the carioles acceleration component. How is it determined? **(08 Marks)**

b. The figure (3.b) shows four-bar mechanism. The link AB rotates with an angular velocity of 10.5 rad /sec and retardation of 26 rad/sec^2 in the directions shown. Find (i) the angular accelerations of the links BC and CD ii) Linear accelerations of points E, F and G. **(12 Marks)**

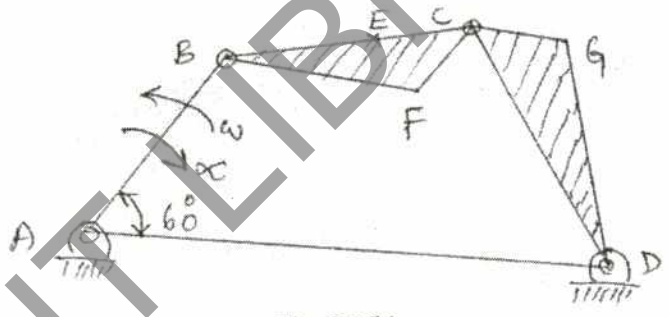

Fig Q3(b)

4 a. State and prove Kennedy's theorem. **(08 Marks)**

b. Explain the method of finding acceleration of various elements by Klein's construction. **(12 Marks)**

PART – B

5 Using complex algebra derive expression for velocity and acceleration of the piston and angular acceleration of connecting rod for a reciprocating engine mechanism. Use these expressions to find the above, if the crank length is 50 mm, connecting rod is 200 mm long, crank angle is 30^0, the crank rotates at a constant speed of 3000 rpm. **(20 Marks)**

6 a. What is interference? Mention the methods to avoid it. **(10 Marks)**

b. Two gear in mesh have 28 and 45 teeth respectively and standard addendum of one module. The module and pressure angles are 6 mm and 20^0 respectively. Determine –

i) Contact ratio,

ii) Angle turned by pinion and gear when one pair is in contact

iii) The ratio of sliding to rolling motion when the tip of a tooth on the larger wheel is just making contact, is just leaving contact with its mating tooth, (iii) is at the pitch point. **(10 Marks)**

7 a. Explain Epicycle gear train with neat figure. **(06 Marks)**

b. Figure shows an Epicyclic gear train where the arm A the driver and annular gear D is the follower. The wheel D has 112 teeth and B has 48 teeth. B runs freely on Pin P and D is separately driven. The arm A runs at 100 rpm and wheel D at 50 rpm in same direction, find the speed of wheel B and C. **(14 Marks)**

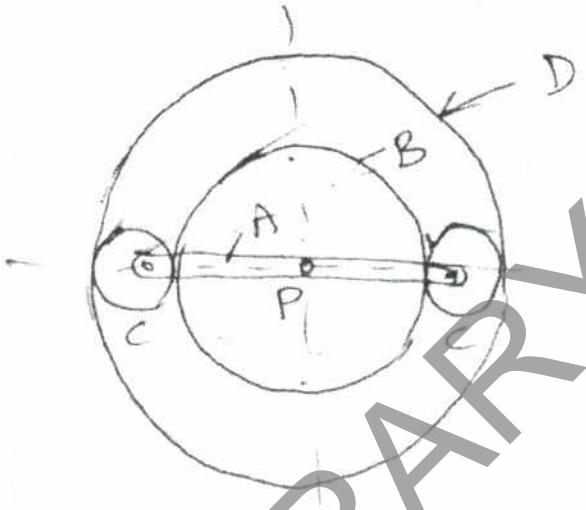

Fig. Q7(b)

8 a. Draw the profile of a cam operating a roller follower with following data.

b. Minimum radius of cam = 25 mm
Lift of follower = 30 mm
Roller diameter = 15 mm
Angle of decent with = 150^0
Uniform acceleration and disceleration
Angle of ascent with 5 rpm = 120^0
Dwell between ascent and descent = 30^0
If the cam rotates at a uniform speed of 150 rpm, calculate the maximum velocity and acceleration of the follower during the descent period. **(20 Marks)**

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06ME45

Fourth Semester B.E. Degree Examination, June-July 2009
Manufacturing Process - II

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions, selecting atleast TWO questions form each Part – A and Part - B.***

PART - A

1 a. With neat sketches, give nomenclature of a single point cutting tool. **(07 Marks)**

b. Derive the conditions $2\phi + \beta - \gamma = \frac{\pi}{2}$. Explain its significance with usual notations. **(07 Marks)**

c. List various factors influencing tool – life. Explain any one of them. **(06 Marks)**

2 a. List various cutting tool materials in the increasing order of their hardness. **(06 Marks)**

b. Explain with the help of neat sketches, heat distribution at tool and workpiece. **(06 Marks)**

c. What are the methods of measurement of temperature of cutting tool tip? Explain any one of them. **(08 Marks)**

3 a. Differentiate between capstan and turret lathes. **(05 Marks)**

b. With a neat sketch, explain any one of the driving mechanisms used in a shaping machine. **(08 Marks)**

c. Sketch a planning machine indicating major parts. Name any one of the mechanism for quick return movement in a planer. **(07 Marks)**

4 a. List various drilling machines. **(05 Marks)**

b. Draw neat sketch of a radial drilling machine indicating parts. **(06 Marks)**

c. Sketch and mention the application of the drilling machine operations – counter boring reaming and trepanning. **(09 Marks)**

PART - B

5 a. With sketches, differentiate between up milling and down milling operations. **(06 Marks)**

b. Draw a neat sketch to show major parts of a horizontal milling machine. **(08 Marks)**

c. What is Indexing? Explain compound indexing. **(06 Marks)**

6 a. List various grinding wheel abrasives and bonding processes. **(07 Marks)**

b. Sketch a centre type – cylindrical grinding machine indicating parts. **(08 Marks)**

c. Differentiate between horizontal and vertical grinding machines. **(05 Marks)**

7 a. Sketch and explain vertical lapping machine. **(08 Marks)**

b. Name the parts along with a neat sketch of a tool head for honing of holes. **(07 Marks)**

c. List the uses of lapping process. **(05 Marks)**

8 a. Mention any five non – traditional machining processes. **(05 Marks)**

b. Explain AJM with a neat sketch. **(10 Marks)**

c. What are the applications of non traditional machining methods? **(05 Marks)**

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06ME46B

Fourth Semester B.E. Degree Examination, June-July 2009
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions choosing at least two questions from each unit.***

PART – A

1 a. Give reasons :
   i) Viscosity of liquids varies with temperature.
   ii) Thin objects float on free surface of static liquid.
   iii) Metacentric height determines stability of floating body.
   iv) Rise of water in a Calillary tube.
   v) Mercury is used as Manometric liquid. **(05 Marks)**

b. Define following terms with their units.
   i) Specific weight ; ii) Kinematic viscosity ; iii) Surface Tension
   iv) Specific gravity ; v) Capillarity **(05 Marks)**

c. The space between two square flat parallel plates is filled with oil. Each side of the plates is 800 mm. Thickness of the oil film is 20 mm. The upper plate moves at a uniform velocity of 3.2 m/sec when a force of 50 N applied to upper plate. Determine :
   i) Shear stress
   ii) Dynamic viscisity of oil in poise
   iii) Power absorbed in moving the plate
   iv) Kinematic viscosity of oil if specific gravity of oil is 0.90. **(10 Marks)**

2 a. State and prove Hydrostatic law. **(05 Marks)**

b. With neat sketch, explain working of differential u-Tube Manometer and derive relation for measuring pressure difference between two pipes. **(05 Marks)**

c. A wooden block of size 6m x 5m x 3m height floats in freshwater. Find the depth of immersion and determine the metacentric height. Specify gravity of wood is 0.70. Find the volume of concrete block placed on the wooden block, so as to completely submerge the wooden block in water. Take specific gravity of concrete as 3.0. **(10 Marks)**

3 a. Explain experimental procedure to determine the metacentric height of a floating vessel. **(04 Marks)**

b. Derive continuity equation for a three dimensional fluid flow in Cartesian co-ordinates. **(08 Marks)**

c. Velocity potential function for a two dimensional fluid flow is given by $\phi = x(2y-1)$. Check the existence of flow. Determine the velocity of flow at a P(2,3) and the stream function. **(08 Marks)**

4 a. Show that streamlines and equipotential lines are orthogonal to each other. **(05 Marks)**

b. Explain Model Similitude and Non-dimensional numbers. **(05 Marks)**

c. The pressure difference Δp for a viscous flow in a pipe depends upon the diameter of the pipe 'D', length of pipe 'L', velocity of flow 'V', viscosity of fluid μ and the density of fluid 'ρ'. Using Buckingham's theorem, show that the relation for pressure difference Δp is given by $\Delta p = \rho V^2 f\left(\frac{1}{Re}, \frac{L}{D}\right)$ **(10 Marks)**

PART – B

5 a. State and prove Bernoulli's equation for a fluid flow. Mention assumptions made in derivation. **(10 Marks)**

b. Water is flowing through a taper pipe of length 150m, having diameter 500 mm at the upper end and 250 mm at the lower end. Rate of flow is 70 liters per sec. The pipeline has a slope of 1 in 30. Find the pressure at the lower end if the pressure at higher level is 2.5 bar. **(10 Marks)**

6 a. Explain with neat sketch, working of pitot-static tube. **(05 Marks)**

b. Differentiate between Orificemeter and venturimeter with neat sketches. **(05 Marks)**

c. A horizontal venturimeter with 50cm diameter at inlet and 20cm throat diameter is used for measuring rate of water flow, if the pressure at inlet is 1.8 Bar and vaccum pressure at the throat is 30cm of mercury, find the rate of flow. Assume 10% differential pressure head is lost between the inlet and throat section. Assume coefficient of discharge is 0.96. **(10 Marks)**

7 a. Derive Hagen-poiseulle's equation for viscous flow through a circular pipe. **(10 Marks)**

b. Rate of water flow through a horizontal pipe is 0.030 m^3/sec. Length of pipe is 1000 meters. Diameter of pipe for first half of length is 200mm and suddenly changes to 400mm for remaining length. Find the elevation difference between the two reservoirs connected by the horizontal pipeline. Take f=0.01 for material of pipeline. **(10 Marks)**

8 a. Explain terms :

i) Lift
ii) Drag
iii) Displacement thickness
iv) Momentum thickness **(08 Marks)**

b. Explain Mach angle and Mach cone. **(04 Marks)**

c. A projectile travels in air of pressure 15 N/cm^2 at 10^0C, at a speed of 1500 km/hr. Find the Mach number and Mach angle. Assume Υ=1.4 and R=287 J/kg^{0}K **(08 Marks)**

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