AIKTC/KRRC/SoET/ACKN/QUES/2019-20/ **Date:** 15/01/2020

School: SoET-CBCS **Branch:** MECH. ENGG. **SEM:** IV

To,
Exam Controller,
AIKTC, New Panvel.

Dear Sir/Madam,

Received with thanks the following **Semester/Unit Test-I/Unit Test-II (Reg./ATKT)** question papers from your exam cell:

Sr. No.	Subject Name	Subject Code	Format		No. of Copies
			SC	HC	
1	Applied Mathematics- IV	MEC401		✓	02
2	Fluid Mechanics	MEC402		✓	02
3	Industrial Electronics	MEC403		✓	02
4	Production Process II	MEC404		✓	02
5	Kinematics of Machinery	MEC405		✓	02

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

27

04/12/19

SE - ME Sem - IV CBCS

[Time: 3 Hours] **[Marks:80]**

Please check whether you have got the right question paper.

N.B:
1. **Question no. 1** is **compulsory**.
2. Answer **any three** from **remaining**.
3. **Figures** to the right **indicate** full **marks**.
4. **Use** of statistical **tables** is **allowed**.

Q.1 a) Find eigen values of A^3-2A^2+I and adj A where $A = \begin{bmatrix} 4 & 1 & -1 \\ 6 & 3 & -5 \\ 6 & 2 & -2 \end{bmatrix}$. **(05)**

Q.1 b) A random variable X has the following probability function. **(05)**

X	0	1	2	3	4
P(X = x)	$\frac{1}{16}$	4K	6K	4K	K

Find (i) K (ii) $P(X < 4)$ (iii) $P(X > 3)$ (iv) $P(0 < X \leq 2)$

Q.1 c) Can it be concluded that the average life-span of an Indian is more than 71 years, if a random sample of 900 Indians has an average life span 72.8 years with standard deviation of 7.2 years? **(05)**

Q.1 d) Consider the following problem: **(05)**

Maximize $Z = 2x_1-2x_2+4x_3-5x_4$

Subject to $x_1 + 4x_2 - 2x_3 + 8x_4 = 2$,

$-x_1 + 2x_2 + 3x_3 + 4x_4 = 1$,

$x_1, x_2, x_3, x_4 \geq 0$

Find a basic feasible solution which is non-degerate and optimal solution.

Q.2 a) Check whether the given matrix A is diagonalizable, diagonalize if it is, **(06)**

Where $A = \begin{bmatrix} 8 & 4 & 3 \\ -8 & -3 & -4 \\ -2 & -2 & 1 \end{bmatrix}$

Q.2 b) Verify Green's theorem for $\vec{F} = x^2i - xyj$ where C is the triangle having vertices A(0,3), B(3,0), C(6,3). **(06)**

SE-sem-IV-Choice Based-Mech

Paper / Subject Code: 41202 / Fluid Mechanics

(3 Hours) **Total Marks: 80**

N.B. : (1) Question No.1 is Compulsory.
(2) Attempt any three Questions out of remaining five questions.
(3) Figures to the right indicate full marks.
(4) Assume any suitable data if necessary and justify the same.

Q1 Solve any Five 20

a) What is the effect of temperature on viscosity of water and that of air 4

b) The weight of a block of dimensions 1.2m X 1m X 1.8 m in water is 2542.8N. Find its weight in air. 4

c) If the velocity field is given by $u = x^2 - y^2$ and $v = -(2xy)$, Check whether 4

i) flow is possible or not ii) rotational or irrotational.

d) The velocity profile within boundary layer for steady, two-dimensional , incompressible, laminar flow over a flat is given by $\frac{u}{U_\infty} = A + B\left(\frac{y}{\delta}\right)$ Using suitable boundary condition, evaluate the constants A and B. 4

e) Explain losses of energy in the flow through pipe. 4

f) State the Bernoulli's Theorem. List out the assumptions and limitations of Bernoulli's equation. 4

Q2 a) The water in a 25 m deep reservoir is kept inside by a 150 m wide wall whose cross section is an equilateral triangle as shown in fig.1. Determine the total force acting on the inner surface of the wall and its line of action. 06

b) The stream function in a two- dimensional, incompressible flow field is given by $\psi = (x^3 - 3xy^2)$. Find the velocity at a point (1, 2) and the velocity potential function. 10

c) Water flows through a 300 mm x 150 mm Venturimeter at a rate of 0.065 m^3/s and the differential gauge is deflected 1.2 m. Specific gravity of the manometric fluid is 1.6. Determine the coefficient of discharge of the Venturimeter. 04

Q3 a) Water is flowing through a horizontal pipe of 15 cm diameter and of length 30 m. While one end of the pipe is connected to a tank, the other end is open to the atmosphere. If the height of water in the tank is 5 m above the centre of pipe, determine the rate of flow of water through the pipe. Take f = 0.03 10

b) A 45° reducing pipe-bend in a horizontal plane has an inlet diameter OD 300mm and outlet diameter of 150 mm. The pressure at outlet is 20 kPa gauge and rate of flow of water through bend is 0.09m³/s. Neglecting friction, determine the magnitude and direction of force required to keep the bend in position. Neglect the weight of the water in the bend. 10

Q4 a) Derive an expression for the area velocity relationship for a compressible fluid flow in the form $\frac{dA}{A} = -\frac{dV}{V}(1 - M^2)$. Explain properly, with the help of diagrams, what are the important conclusions derived from the above relationship. 10

b) The local velocity u in a laminar, incompressible flow over a flat plate is given by $\frac{u}{U_\infty} = 2\left(\frac{y}{\delta}\right) - 2\left(\frac{y}{\delta}\right)^3 + \left(\frac{y}{\delta}\right)^4$ where y is perpendicular distance from the plate, δ is the boundary layer thickness and U_∞ is the free stream velocity. Obtain the expression for the displacement thickness and momentum thickness. 10

Q5 a) An aeroplane is flying at 900 km/hr through still air having a pressure of 80 kN/m² and temperature of – 8°C. Find the Mach number. Also find stagnation properties on the nose of the plane. Take R = 287 J/Kg°K and k = 1.4 . 10

b) Derive Euler's equation of motion along streamline 10

Q6 a) Explain what is meant by separation of boundary layer and describe in detail the methods to control this? 06

b) State Reynold's Transport theorem and explain each term in detail. 04

c) An oil with density 850 kg/m³ and viscosity 0.16 Ns/m² flows through a 20 cm diameter pipe at a rate of 1.2 lit/sec. If the length of the pipe is 500 m, find the pressure drop between the two ends of the pipe. Also calculate the shear stress at the pipe wall. 10

SE - sem - IV - choice Based - Mech

14/12/19

[3 Hours] [Marks: 80]

Please check whether you have got the right question paper.

N.B:
1. Question No. 1 is compulsory.
2. Solve any three questions out of remaining three questions.
3. Figures to the right indicate full marks.

1. (a) Draw and explain V-I characteristics of SCR. 05
   (b) Draw and explain equivalent circuit of an OP-AMP. 05
   (c) State and prove Demorgan's Theorems. 05
   (d) Enlist all important features of logic family circuit. 05

2. (a) Draw and explain slip-torque characteristics of AC motor. 07
   (b) What is GTO? Explain switching characteristics of GTO. 07
   (c) Compare DIAC and TRAIC. 06

3. (a) Draw and explain full controlled rectifier with R load. Draw waveforms. 07
   (b) Explain with neat diagram MSP 430 architecture. 07
   (c) Draw and explain second order low pars filter. 06

4. (a) Draw circuit diagram and waveforms of single phase full bridge inverter with R load. 07
   (b) Compare CMOS logic family with TTL logic family. 07
   (c) What is servo speed? Explain working principle of servo motor. 06

5. (a) Derive the relation per voltage gain in inverting mode in operational amplifier and compare it with non inverting mode. 07
   (b) Draw and explain R triggering method of SCR. 07
   (c) Draw and explain astable mode of operation of IC 555. 06

6. (a) Explain the application of piezo-electric activator drive. 07
   (b) Compare DC series motor and DC shunt motor. 07
   (c) Explain different applications of microcontroller. 06

SE - sem - IV - choice Based - Mech 13/12/19

(3 Hours) [Total Marks : 80]

Please check whether you have got the right question paper.

N.B.: 1) **Question No 1. is compulsory.**
2) **All questions carry equal marks.**
3) **Attempt any 3 out of the remaining 5 questions.**

1. Attempt **any four** (20)
   a) Describe one RP process with a neat sketch.
   b) Describe the factors affecting MRR in AJM.
   c) What is meant by dressing, trueing and balancing of grinding wheel.
   d) Describe features and mechanism of a compound die.
   e) What are the conditions under which different types of chips are formed in metal cutting?

2. a) What are the factors determining MRR in EBM? (10)
   b) Describe chip formation in orthogonal cutting process. (10)

3. a) Describe the process of finding center of pressure (10)
   b) State the principles of location w.r.t. Jigs and Fixtures. (10)

4. a) What is the nomenclature for expressing the cutting tool signature in MRS. Draw a sketch also. (10)
   b) Describe the process of photo-polymerization with a neat labelled sketch. (10)

5. a) In an orthogonal cutting operation, the rake angle is 5^0, chip thickness before the cut = 0.2mm and width of cut = 4mm. The chip thickness ratio is 0.4. (10)
      i. Determine the chip thickness after the cut.
      ii. Determine shear angle
      iii. Determine friction angle
      iv. Determine co-efficient of friction
      v. Determine shear strain
   b) Determine the parentage change in cutting speed required to give 50% reduction in tool life. Take n = 0.2 (10)

6. **Attempt all of the following** (20)
   a) Draw a neat labelled sketch of a typical twist drill.
   b) Differentiate between Transferred and non-transferred plasma arc machining process.
   c) Describe the dynamometer used in Milling Machine.
   d) Classify various locators used in Jigs and Fixtures.
   e) How does a welding fixture differ from a machining fixture?

Paper / Subject Code: 41205 / Kinematics of Machinery

03 Hrs **[Total Marks 80]**

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

Q.1 **Attempt any four** 20

A. What is Kutzback's criterion for degrees of freedom of plane mechanism? In what way is Gruebler's criterion different from it?.

B. Differentiate between lower pair and higher pair.

C. Define with respect to cam i) Base circle ii) pitch circle iii) trace point iv) pressure angle.

D. What is crowning of pulley in flat drives? What is its use.

E. Explain the self locking and self energizing in brakes.

Q.2A. The mechanism, as shown in Fig.1, has the dimensions of various links as follows : AB = DE = 150 mm ; BC = CD = 450 mm ; EF = 375 mm. The crank AB makes an angle of 45° with the horizontal and rotates about A in the clockwise direction at a uniform speed of 120 r.p.m. The lever DC oscillates about the fixed point D, which is connected to AB by the coupler BC. The block F moves in the horizontal guides, being driven by the link EF. Determine velocity of the block F and angular velocity of DC 14
1. By instantaneous centre method
2. By relative velocity method

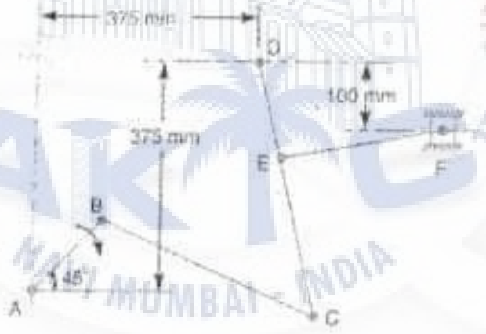

Figure 1

B. State and prove law of gearing. 06

Q.3A. A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact. 10

B. An open belt drive is required to transmit 10KW of power from a motor running at 600rpm. Diameter of the driving pulley is 250mm. The speed of the driven pulley is 220rpm. The belt is 12mm thick and has a mass density of $0.001 g/mm^3$. Safe stress in the belt is not to exceed $2.5 N/mm^2$. The two shafts are 1.25 m apart. The coefficient of friction is 0.25. Determine the width of the belt. 10

Q.4 A. The mechanism as shown in fig. 2 of a radial valve gear. The crank OA turns uniformly at 150 r.p.m and is pinned at A to rod AB. The point C in the rod is guided in the circular path with D as centre and DC as radius. The dimensions of various links are: OA = 150 mm ; AB = 550 mm ; AC = 450 mm ; DC = 500 mm ; BE = 350 mm.
Determine velocity and acceleration of the ram E for the given position of the mechanism. 14

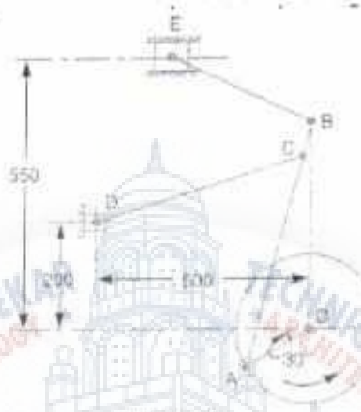

Figure 2

B. What is pantograph? Show that it can produce paths exactly similar to the ones traced out by a point on a link on an enlarged or reduced scale. 06

Q.5A. In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D - E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 r.p.m. clockwise 08

B. A sphere of radius 0.2m starts rolling without slip up an inclined at an angle of 30^0 with the horizontal. If the initial velocity of sphere 10rad/s. Determine how far sphere will travel before it reverse its motion. 06

C. Explain chordal action in chain drive. 06

Q.6A. Prove that the velocity of sliding in gears is proportional to the distance of the point of contact from the pitch point . 08

B. A cam is rotating at 800 rpm operate a reciprocating knife edge follower. The least radius of cam is 30mm , stroke of follower is 30mm. Ascent takes place by uniform accelereation and deceleration and descent by simple harmonic motion. Ascent take place by 120^0 and descent during 90^0 of cam rotation. Dwell between ascent and descent 30^0. Sketch displacement, velocity and acceleration. 12
