



ANJUMAN-I-ISLAM'S

AIKTC KALSEKAR TECHNICAL CAMPUS

INNOVATIVE TEACHING - EXUBERANT LEARNING

School of Architecture

School of Engineering & Technology

School of Pharmacy

Knowledge Resource & Relay Centre (KRRC)

AIKTC/KRRC/SoET/ACKN/QUES/2017-18/

Date: _____

School: SoET-CBSGS

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	Theory Of Machines-I	MEC403		✓	02
4	Production Process-Ii	MEC404		✓	02
5	Material Technology	MEC405		✓	02
6	Industrial Electronics	MEC406		✓	02

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

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19/11/1

SE-SEM-IV - CBSGS - CIVIL/Mech

Q. P. Code: 36431

[3hours]

Total Marks 80

N.B. (1) Question No 1 is compulsory

(2) Attempt any 3 of the remaining

(3) Use of statistical table is allowed

1. a) A variable X follows a Poisson distribution with variance 3. Find (5)

$P(x=2)$ and $P(x \geq 2)$

b) Evaluate $\iiint (9xi + 6yj - 10zk) ds$ where s is surface of the sphere with radius 2, using Gauss divergence theorem. (5)

c) Ten individuals are chosen at random from a population and their heights are found to be 63, 63, 64, 65, 66, 69, 69, 70, 70, 71 inches. Discuss the suggestion that the mean height of the universe is 65 inches. (5)

d) Using Cayley- Hamilton Theorem find $2A^5 - 3A^4 + A^2 - 4I$ where $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ (5)

2. a) A continuous random variable X has the probability density function $f(x) = kx^2e^{-x}$, $x \geq 0$. Find k, mean and variance (6)

b) Ten school boys were given a test in statistics and their scores were recorded. They were given a months special coaching and a second test was given to them in the same subject at the end of the coaching period. Test if the marks given below give evidence to the fact that the students are benefitted by the coaching.

Marks in Test I : 70, 68, 56, 75, 80, 90, 68, 75, 56, 58

Marks in Test II : 68, 70, 52, 73, 75, 78, 80, 92, 54, 55 (6)

c) Two lines of regression are given by $x+6y = 6$, and $3x+2y = 10$ calculate (i) mean values of x and y, (ii) the coefficient of correlation and (8)
(iii) estimate y when $x = 12$

3. a) It is known that the probability of an item produced by a certain machine will be defective is 0.05. If the produced items are sent to the market in packets of 20, find the number of packets containing (i) at least 2, (ii) exactly 2 and (iii) at most 2 defective items in a consignment of 1000 packets using Poisson distribution (6)

b) Use Stoke's theorem to evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = yzi + xzj + xyk$ and c is the boundary of the circle $x^2 + y^2 + z^2 = 1, z=0$ (6)

c) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ (8)

4. a) Out of 800 people 25% were literate and 300 had travelled beyond the limits of the district. 40 % of the literates were among those who had not travelled. Prepare a 2x2 table and test at 5% level of significance whether there is any relation between travelling and literacy (6)

b) Compute rank correlation coefficient from the following

X : 10, 12, 18, 18, 15, 40

Y : 12, 18, 25, 25, 50, 25 (6)

c) The marks of 1000 students of a university are found to be normally distributed with mean 70 and standard deviation 5. Estimate the number of students whose marks will be (i) between 60 and 75 (ii) more than 75 (iii) less than 68 (8)

5.a) A machine is set to produce metal plates of thickness 1.5 cms with standard deviation of 0.2 cms. A sample of 100 plates produced by the machine gave an average thickness of 1.52 cms. Is the machine fulfilling the purpose? (6)

b) Using the method of Lagrange's multipliers solve the following N.L.P.P

$$\text{Optimise } z = 6x_1^2 + 5x_2^2$$

$$\text{Subject to } x_1 + 5x_2 = 7,$$

$$x_1, x_2 \geq 0$$

(6)

c) If the vector field \vec{F} is irrotational find the constants a,b,c where \vec{F} is given by $\vec{F} = (x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)k$. Find the scalar potential of \vec{F} . Then find the workdone in moving a particle in this field from (1,2,-4) to (3,3,2) along the straight line joining these points (8)

6.a) Using Green's theorem evaluate $\int_C (xy + y^2)dx + x^2 dy$ where c is the closed curve

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of the region bounded by $y = x$, $y = x^2$ (6)

b) Show that $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ is derogatory and find its minimal polynomial (6)

c) Using the Kuhn-Tucker conditions solve the following problem (8)

$$\text{Maximise } z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$$

$$\text{Subject to } x_1 + x_2 \leq 2, \quad 2x_1 + 3x_2 \leq 12$$

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

Q. P. Code : 27043

[Time : 3 hours]

[Marks : 80]

Instructions : Question no 1 is COMPULSORY
Attempt any 3 questions from question no 2 to 6
Use illustrative diagrams wherever possible
Assume suitable data if necessary

- Q1** Solve any 4 of the 5 sub questions
- a** Two large plane surfaces are 2.4cm apart. The space between the surfaces is filled with glycerin. What force is required to drag a very thin plate of surface area 0.5 square meter between the two large plane surfaces at a speed of 0.6m/s^2 if the thin plate is at a distance of 0.8cm from one of the plane surfaces? Take dynamic viscosity of glycerin = 0.81 N-s/m^2 **5**
- b** The stream function for a two dimensional flow is given by $\psi = 2xy$, calculate the velocity of the point P(2,3). **5**
- c** A projectile travels in air of pressure 10.1043 N/cm^2 at 10°C at a speed of 1500 kmph. Find the Mach number and the Mach angle. Take $k=1.4$ and $R=287\text{ J/kg K}$ **5**
- d** Define the following terms : **5**
i) Boundary Layer Thickness
ii) Displacement Thickness
- e** Explain the working of a Orificemeter **5**
- Q2**
- a** A simple manometer is used to measure the pressure of oil (sp gr 0.8) flowing in the pipeline. It's right limb is open to atmosphere and the left limb is connected to the pipe. The centre of the pipe is 9cm below the level of mercury (sp gr 13.6) in the right limb. If the difference of mercury level in the two limbs is 15cm, determine the absolute pressure of the oil in the pipe in N/cm^2 . **8**
- b** A horizontal pipe line 50m long is connected to a water tank at one end discharges freely into the atmosphere at the other end. For the first 30m of its length from the tank, the pipe is 200mm in diameter and its diameter is suddenly enlarged to 400mm. The height of water level in the tank is 10m above the centre of the pipe. Considering all minor losses, determine the rate of flow. Take $f=0.01$ for both sections of the pipe. **12**
- Q3**
- a** For a two dimensional potential flow, the velocity potential function is given by : $\Phi = 4x(3y-4)$, determine the velocity at the point (2,3). Also determine the value of the stream function ψ at the point (2,3) **10**
- b** The velocity profile within a laminar boundary layer over a flat plate is given by **10**

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

Where U is the main stream velocity and δ is the boundary layer thickness.
Determine the i) Displacement thickness and ii) Momentum thickness

- Q4** **a** Derive the Euler's equation of motion and obtain the Bernoulli's equation. State **10**
the assumptions made.
- b** Calculate the stagnation pressure , temperature and density at the stagnation point **10**
on the nose of a plane, which is flying at 800 kmph through still air having a
pressure of 8.0 N/cm^2 (abs) and temperature -10^0 C . Take $R = 287 \text{ J/kg K}$ and
 $k=1.4$
- Q5** **a** A 300mm diameter pipe carries water under a head of 20 meters with a velocity of **10**
 3.5m/s . If the axis of the pipe turns 45^0 , find the magnitude and the direction of the
resultant force of the bend. Assume the pipe to be in the horizontal plane.
- b** A fluid of viscosity 0.7 N-s/m^2 and specific gravity 1.3 is flowing through a circular **10**
pipe of diameter 100mm. The maximum shear stress at the pipe wall is given as
 192.6 N/m^2 , find the i) pressure gradient ii) average velocity iii) Reynold's
number of the flow.
- Q6** **a** Draw a neat sketch of Venturimeter and derive an expression for discharge through **10**
the venturimeter. Explain the terms C_d , C_v and C_c .
- b** Solve any 2 of 3 sub questions below
- i** Define the terms Drag and Lift **5**
- ii** State and explain the hydro static law **5**
- iii** Explain the Critical Pressure ratio **5**

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- N.B. 1) Question No.1 is compulsory.
2) Attempt any three questions out of the remaining five questions.
3) Figures to the right indicate full marks.
4) Assume suitable data wherever required but justify the same.

Q1. Attempt any four (20)

- A. What are the advantages and disadvantages of chain drive over belt drive?
- B. Differentiate between cycloidal and involute teeth gear.
- C. What are the different types of instantaneous centers?
- D. Classify Cams in detail.
- E. State and explain Work – Energy principle and conservation of energy.

Q2 A. Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by cross belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rpm, if the maximum permissible tension in the belt is 1×10^3 N and the coefficient of friction between the belt and the pulley is 0.25? (10)

B. Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. If addendum on each wheel is such that path of contact is maximum and interference is just avoided, find the path of contact, arc of contact and contact ratio. Also find the addendum for each wheel. (10)

Q3 A. A cam rotating at 150 rpm operates a reciprocating roller follower of radius 2.5 cm. The least radius of the cam is 5 cm and the stroke of the follower is 5 cm. Ascent and descent both takes place by uniform acceleration and retardation. Ascent takes place during 75° and descent during 90° of cam rotation. Dwell between ascent and descent is 60° . Sketch displacement, velocity and acceleration diagrams and mark salient features. (10)

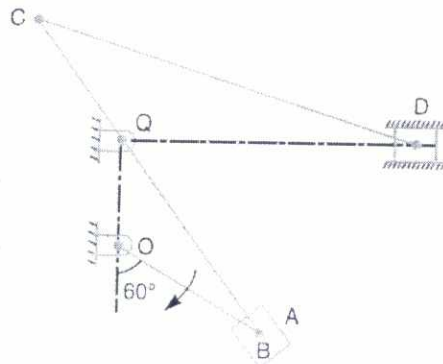
B. Derive an expression for the ratio of shaft velocities for Hooke's joint and draw the polar diagram depicting the salient features of driven shaft speed. (10)

Q4 A. The reduction of speed from 360 rpm to 120 rpm is desired by the use of chain drive. The driving sprocket has 10 teeth. Find the number of teeth on the driven sprocket. If the pitch radius of the driven sprocket is 250 mm and the center to center distance between the two sprocket is 400 mm, find the pitch and the length of the chain. (10)

B. Derive an expression for minimum number of teeth required on a pinion to avoid interference in involute gear teeth when it meshes with wheel. (10)

{ Turn Over

- Q5 A.** What do you understand by coriolis component of acceleration? Explain with the help of an example. Draw all the directions of coriolis component of acceleration. (10)
- B.** A cylinder with mass of 50 kg is released from the rest on a plane inclined at 30° to the horizontal. The diameter of the cylinder is 2 m. If the cylinder rolls without slipping, then compute, i) the speed of the center point C of the cylinder after it has moved 2 m along the inclined plane and ii) friction force acting on the cylinder. (10)
- Q6 A.** Figure shows a Whitworth quick return motion mechanism. The various dimensions are : $OQ = 100$ mm; $OA = 200$ mm; $QC = 150$ mm; $CD = 500$ mm. The crank OA makes an angle of 60° with the vertical and rotates at 120 rpm in the clockwise direction. By instantaneous center method find the velocity of the ram D . Compare your answer with relative velocity method. (14)



- B.** With the help of a neat sketch explain the terms base circle, prime circle and pitch circle with respect to cams. (6)

(7)

10/12/18

(3 Hours)

[Total Marks : 80]

- N.B. (1) Question no. 1 is compulsory.
(2) Attempt any **three** questions out of remaining **five** questions.
(3) **Illustrate** your answer with **necessary** sketch wherever **necessary**.
(4) **Figures** to the **right** indicate full **marks**.
(5) **Assume** suitable data wherever **necessary**.

1. Attempt any **FOUR** of the following : (20)
- (a) What is undercutting of gear teeth?
 - (b) Explain about closed loop systems in CNC machines.
 - (c) Explain the expression for shear plane angle in metal cutting.
 - (d) What is surface finish?
 - (e) Explain different types of milling cutters.
2. (a) What are the basic elements of drilling machine? Explain function of each. (10)
(b) Write about GM codes in CNC machines. (6)
(c) Write about the maintenance of CNC machines. (4)
3. (a) While machining a mild steel rod on the lathe, following results were obtained: (10)
Width of cut = 2.5 mm, Uncut chip thickness = 0.27 mm, Chip thickness = 0.7 mm, Rake angle = 0 degree, Cutting force = 900 N, Thrust force = feed force = 450 N. Determine (i) Chip thickness ratio (ii) Chip reduction ratio (iii) Shear plane angle (iv) Coefficient of friction (v) Friction angle.
(b) What is gear grinding? (6)
(c) Explain gear hobbing process of gear manufacturing. (4)
4. (a) State the requirement of dynamometer and explain any one mechanical dynamometer. (10)
(b) Explain machinability. (6)
(c) Write about tool angles in ASA (American Standards Association) system with neat sketch. (4)
5. (a) Describe HSS (High Speed Steel) tool. (10)
(b) Write about Single point cutting tool. (6)
(c) Describe various broach terms with neat sketch. Write the formula for the following elements- Total number of teeth in a broach, Effective length. (4)
6. Write short notes on: (20)
- (a) Classification of shapers.
 - (b) Geometry of milling cutter.
 - (c) Nomenclature of drilling tool.
 - (d) Form tool.
 - (e) Factors affecting tool life.
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- N.B:** (1) Question No. 1 is compulsory.
(2) Attempt any three questions from remaining five questions.
(3) Figures to the right indicate full marks
(4) Illustrate the answer with neat sketches wherever required.
(5) Answers to questions should be grouped & written together.

1. Write short note on **any four** of the following: (20)
 - a) Ceramic Materials.
 - b) Fatigue Failure
 - c) Hume Rothery's rules of solid solubility
 - d) Critical cooling curve
 - e) Classification of alloying elements.

 2. (a) What are surface defects? Illustrate and discuss the various types of surface defects. (8)
(b) What are the objectives of heat treatment of metals? Give classification of heat treatment processes. (6)
(c) Explain the mechanism of creep failure. (6)

 3. (a) Draw a neat and labelled TTT diagram for eutectoid steel. Superimpose the CCT, CCR and various other cooling curves showing a different transformed product. (8)
(b) What is Surface hardening? Explain the flame hardening heat treatment process. (6)
(c) Differentiate between Edge dislocation and Screw dislocation. (6)

 4. (a) Define strain hardening. Explain the effect of strain hardening on behavior of materials. (8)
(b) Discuss the cyclic Annealing heat treatment of Steel. (6)
(c) Draw a typical eutectoid type diagram and explain its important features. (6)

 5. (a) Discuss Griffith's theory and derive the Griffith's equation. (8)
(b) Discuss the Ausforming heat treatment of Steel. (6)
(c) Write a note on "Jominy End Quench Test". (6)

 6. (a) Explain in detail the Heat Treatment for 18-4-1 Tool Steel. (8)
(b) Define fatigue failure. Draw and explain the S-N curve. (6)
(c) Give classification of Nano-materials with advantages, disadvantages and applications. (6)
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20/12/18

(3 Hours)

[Total Marks: 80]

- N.B:** (1) Question no.1 is compulsory
(2) Solve any three from remaining five questions
(3) Assume suitable data if necessary
(4) Figures to the right indicate full marks

1. Solve any 4: 20
(a) List the characteristics of an ideal op-amp.
(b) What is SCR and state its application.
(c) Realize basic gates using NAND gate.
(d) Explain Back EMF in D.C motors.
(e) State advantages of Digital Circuits.
2. (a) What is an inverter? Classify it according to their input supply and explain any one. 7
(b) Derive the output voltage for full wave fully controlled rectifier and find firing angle for maximum output. 7
(c) Compare power BJT, power MOSFET and IGBT. 6
3. (a) Explain in detail the concept of R-L-E load in converters 7
(b) Draw and explain architecture of MSP430 microcontroller 7
(c) Discuss Torque Speed characteristic of D.C motor? Classify types of load on the basis of Time duration. 6
4. (a) What is the necessity of inner current loop control circuit. 7
(b) Explain IC 555 as a Monostable Multivibrator. 7
(c) How SCR Gate Drive R-C Circuit Work. 6
5. (a) Explain any one application circuit of TRIAC-DIAC pair. Also, draw the V-I characteristics of TRIAC and DIAC. 7
(b) Compare combinational and sequential circuits. Explain any one combinational circuit. 7
(c) Explain minimum six distinguishing features of MSP430 Microcontroller 6
6. (a) Explain register related to configuration of digital input/output port of MSP 430 microcontroller. 7
(b) Explain how to select a motor for water pumping application and describe with Speed Torque Characteristic? 7
(c) What do you understand by a digital circuit? Elaborate following terms related to digital circuits:
(i) Logic level (ii) Noise immunity (iii) Propagation delay
(iv) Power dissipation (v) Fan out 6
