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

School: SoET-CBSGS **Branch:** ALL BRANCHES **SEM:** I

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- I	FEC101		✓	02
2	Applied Physics- I	FEC102		✓	02
3	Applied Chemistry- I	FEC103		—	—
4	Engineering Mechanics	FEC104		✓	02
5	Basic electrical & electronic Engineering	FEC105		✓	02
6	Environmental studies	FEC106		—	—

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

FE-Sem -I – CBSGS

15/11/18

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

Please check whether you have got the right question paper.

N.B: 1. Question 1 is compulsory.
2. Attempt any three questions from Q.2 to Q.6.

Q1 (a) Prove $cosh^5x = \cosh 5x + 5\cosh 3x + 10\cosh x$ **(3)**

(b) If $u = \log(\tan x + \tan y)$
Prove $\sin 2x \frac{\partial u}{\partial x} + \sin 2y \frac{\partial u}{\partial y} = 2$ **(3)**

(c) If $u = \frac{yz}{x}$, $v = \frac{zx}{y}$, $w = \frac{xy}{z}$ Show that $\frac{\partial(u,v,w)}{\partial(x,y,z)} = 4$ **(3)**

(d) Express the following matrix as sum of symmetric and skew symmetric matrix. **(3)**

$$A = \begin{pmatrix} 2 & 2+i & 3 \\ -2+i & 0 & 4i \\ -i & 3-i & 1-i \end{pmatrix}$$

(e) Show that $\log(1+\sin x) = x - \frac{x^2}{2} + \frac{x^3}{6} \ldots$ **(4)**

(f) If $y = \frac{x^2}{(x-1)(x-2)}$ Find y_n **(4)**

Q2 (a) Solve the Equation $x^4 - x^3 + x^2 - x + 1 = 0$ **(6)**

(b) Reduce the following Matrix to the Normal form and hence find the rank of the matrix **(6)**

$$A = \begin{pmatrix} 6 & 1 & 3 & 8 \\ 4 & 2 & 6 & -1 \\ 10 & 3 & 9 & 7 \\ 16 & 4 & 12 & 15 \end{pmatrix}$$

(c) If $u = \frac{x^2y^2z^2}{x^2+y^2+z^2} + \cos^{-1}\left(\frac{xy+yz}{\sqrt{x^2+y^2+z^2}}\right)$ **(8)**

Find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}$

Q3 (a) (a) Investigate for what values of λ and μ the system of equations **(6)**
x+2y+3z= 4, x+3y+4z = 5, x+3y+λz =μ.
have 1) unique solution, 2) Infinite solutions, 3) No solution

(b) Find the Extreme values of f(x,y)= xy+ $a^3(\frac{1}{x}+\frac{1}{y})$ **(6)**

(c) Separate into real and imaginary parts of $\tan^{-1}(e^{i\theta})$ **(8)**

Q4 (a) If $u^2 + xv^2 = x + y$, $v^2 + yu^2 = x - y$ Find $\frac{\partial u}{\partial x}\frac{\partial v}{\partial y}$ **(6)**

(b) If log cos(x+iy)= a+ib Prove $2e^{2a}$= cosh2y +cos 2x **(6)**

(c) **(8)**
Solve the following Equations by Gauss Seidel method Upto four iterations.
4x-2y-z= 40 , x-6y+2z= -28, x-2y+12z= -86

Q5 (a) Using De Moivre's theorem Prove **(6)**
$\cos^7\theta = \frac{1}{2^6}(\cos 7\theta + 7\cos 5\theta + 21\cos 3\theta + 35\cos\theta)$

(b) Evaluate $\lim_{x\to 0}\left(\frac{1}{x^2} - \cot^2 x\right)$ **(6)**

(c) If $y = \sin(m\sin^{-1}x)$ Prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$ **(8)**
And hence find $y_3(0)$.

Q6 (a) (a) Show the following vectors are linearly dependent and find the relation between them. **(6)**
[2, −1,3,2] ,[1,3,4,2] ,[3, −5,2,2] .

(b) If z=f(x,y) where x = u cosh v , y = usinh v Prove **(6)**
$(\frac{\partial z}{\partial x})^2 - (\frac{\partial z}{\partial y})^2 = (\frac{\partial z}{\partial u})^2 - \frac{1}{u^2}(\frac{\partial z}{\partial v})^2$

(c) Fit the curve of the form $y= ab^x$ to the following data. **(8)**

x	2	3	4	5	6
y	144	172.8	207.4	248.8	298.5

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(2)

Paper / Subject Code: 58505 / Applied Physics - I.

FE-Sem-I-CBSGS

27/11/19

Time: 2 Hours **Marks: 60**

N:B
1. Question **No.1** is compulsory.
2. Attempt any **Three** questions from the remaining questions Nos.2 to 6.
3. Assume suitable data wherever required.
4. Figures to the right indicate marks.

Q.1 Attempt **Any Five**

a) Define the following terms 1) Space lattice 2) Unit cell 3) lattice point **03**

b) Distinguish between insulators, conductors and semi-conductors in terms of their energy bands. **03**

c) What are liquid crystals? List the various types of liquid crystals. **03**

d) What are polar and non-polar dielectrics? **03**

e) Define relative permeability and susceptibility. Write the relation between them. **03**

f) A classroom has dimensions 20x15x5 m^3, the reverberation time is 3.5sec.Calculate the total absorption of its surfaces and the average absorption coefficient. **03**

g) What are ultrasonic waves? State the direct piezoelectric effect. **03**

Q.2 a) Show that Fermi level in intrinsic semiconductor lies at the centre of the forbidden band. $E_F=E_C+E_V/2$ **08**

b) Draw the following: (i) (2 3 1) (ii) [2 0 1] (iii) $(\bar{1}\ 2\ \bar{1})$ Calculate the packing efficiency for Body centered cubic cell? **07**

Q.3 a) Explain various stages of hysteresis and give the significance of hysteresis **08**

b) Deduce the Braggs law for the diffraction of X- rays in crystals. **07**

Q.4 a) For a cubic structure in a crystal, derive an expression for interplanar spacing between the planes with miller indices (hkl) **05**

b) What is potential barrier? How is it formed in a p-n junction? **05**

c) Derive Clausius –Masotti relation for non-polar dielectrics. **05**

Q.5 a) Copper has F.C.C. structure and the atomic radius is 1.28 Å. Calculate its density. (At wt = 63.54, $N_A = 6.023 \times 10^{23}$) **05**

b) A copper strip 2cm wide and 1mm thick is placed in a magnetic field with B=1.5 Wb/m^2.If current of 200 A is set up in the strip, calculate Hall voltage that appears across the trip. Given $R_H = 6 \times 10^{-7}\ m^3/C$. **05**

c) Explain in detail the conditions necessary for good acoustical design of an auditorium **05**

Q.6 a) What are real crystals?
Differentiate between Frenkel and Schottky defect **05**

b) Define the terms:i) mobility ii) conductivity.
Find the resistivity of intrinsic germanium at 300K.Given the density of carriers as $2.5 \times 10^{19}\ /m^3$, $\mu_e = 0.39\ m^2/V\text{-sec}$ and $\mu_h = 0.19 m^2\ /V\text{-sec}$. **05**

c) Find the natural frequency of vibration of quartz plate of thickness 1.8mm.Given Young's modulus for quartz is $8 \times 10^{10}\ N/m^2$, Density of quartz is $2650\ kg/m^3$. **05**

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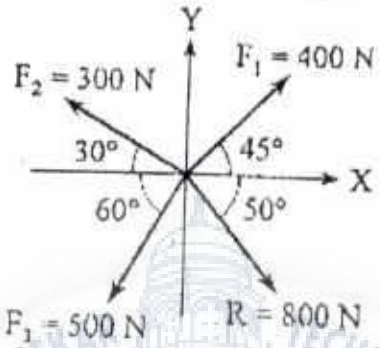
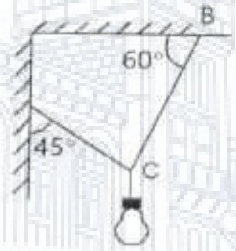
(3 Hours) (Total Marks : 80)

N.B.: 1. **Question No. 1** is **compulsory**.
2. Attempt **any 3** more questions from remaining **five**.
3. Assume **suitable data** if **necessary**, and **mention** the **same clearly**.
4. **Figures** to the **right** indicate **full mark**.
5. Take **g= 9.81m/s²**.

1. a) Forces F_1,F_2, F_3 and F_4 are acting on a particles. Find the force F_4 so as to give the resultant of system of concurrent forces R = 800 N as shown in figure. **[4]**



b) A light fixture weighing 24 N is hung by a string as shown in figure. Determine the tensions in AC and BC of the string. **[4]**

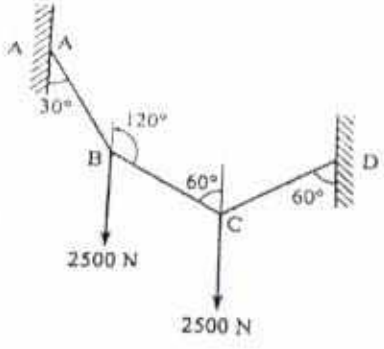


c) State various laws of friction. **[4]**

d) The motion of a particle is defined by the relation $v = 4t^2-3t-1$ where v is in m/s and t is in sec. If the displacement $x = -4$m at t = 0, determine the displacement and acceleration at t = 3 sec. **[4]**

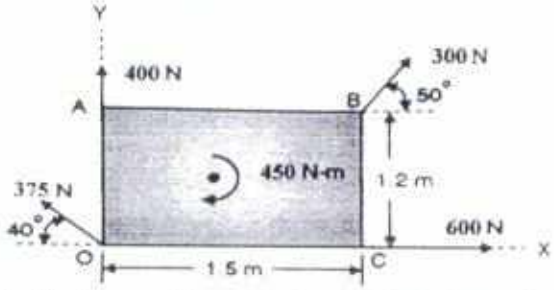
e) A car travelling at a speed of 60m/s is braked and comes to rest in 10 seconds after the brakes are applied. Find the minimum coefficient of friction between the wheels and the road. **[4]**

2. a) Two equal loads of 2500 N are supported by the flexible string ABCD at point B and C. Find the tension in the portion AB, BC and CD of the string. **[8]**



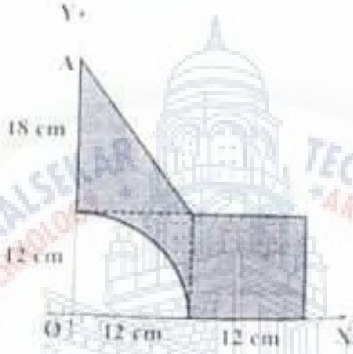
b) Find the resultant of the force system on a body OABC as shown in figure. Also find the

points where the resultant will cut the X and Y axis. [6]

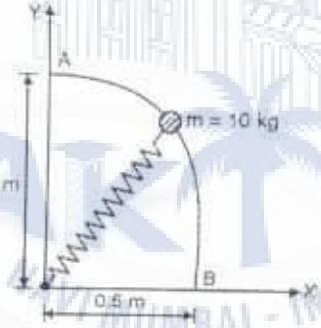


c) If a ball is thrown vertically down with a velocity of 10m/s from a height of 3m. Find the maximum height it can reach after hitting the floor, if the coefficient of restitution is 0.7. [6]

3. a) Determine the Centroid of the shaded area. [8]

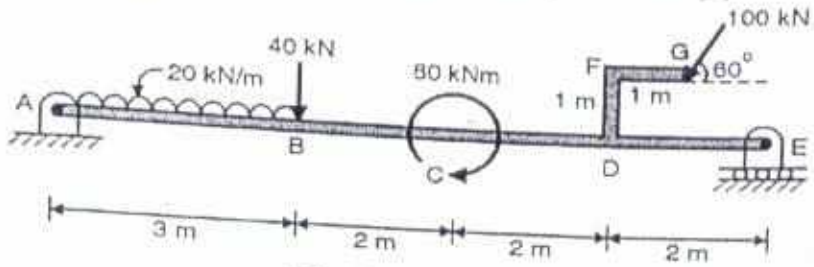


b) The 10kg mass slides from rest at A along the frictionless rod. Determine the speed at B. Stiffness of the spring K = 80 N/m. Unstretched length of spring is 0.3 m. [6]



c) A force $\mathbf{F = 80i + 50j - 60k}$ passes through a pont A (6,2,6). Compute its moment about origin. [6]

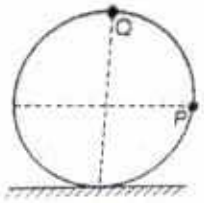
4. a) Find support reactions at A and E for the beam loaded as shown in fig. [8]



b) An aero plane flying horizontally with a velocity of 100m/s releases a packet which lands to the ground after 8 seconds. Find the velocity with which the packet lands. [6]

Also find the height from which it was released.

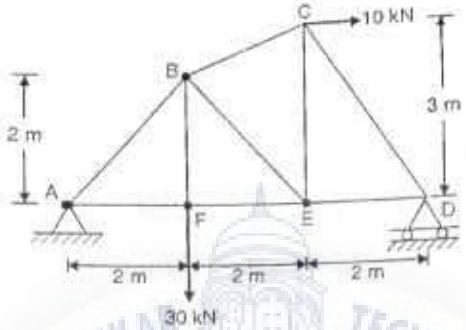
c) A wheel of radius 0.75m rolls without slipping on a horizontal stationary surface to the right. Determine the velocities of the points P and Q when the velocity of centre of the wheel is 25 m/s to the right. [6]



5. a) For the truss shown in Fig, determine :

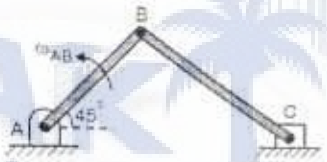
i) Forces in members AB, BF and EF by method of sections only. [3]

ii) Forces in all other members by method of joints. [5]

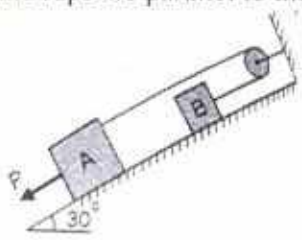


b) A motorcycle starts from rest and accelerates at 2m/s^2 till velocity reaches 10m/s. Then it accelerates at 1m/s^2 till velocity reaches 15m/s and continues at uniform velocity of 15m/s till it covers a total distance of 300m. Find the total time taken to cover this distance. Draw the v-t and x-t graph for this motion. [6]

c) In the slider crank mechanism shown in fig. the crank AB of length 10 cm rotates anti-clockwise with an angular velocity of 6 rad/sec. The connecting rod BC is 45 cm in length and the slider at C is constrained to move along a horizontal line. At the instant shown, find the angular velocity of rod BC and velocity of slider at C. [6]



6. a) Determine the force P to cause motion to impend. Take masses of blocks A and B as 8kg and 4kg respectively. Coefficient of static friction between sliding surfaces is 0.2. Assume smooth pulley. The force P and the rope are parallel to the inclined plane. [8]

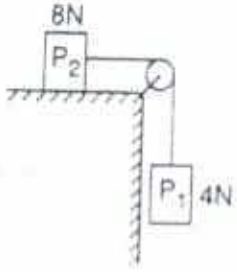


b) Explain conditions for equilibrium for different system of forces in space. [4]

c) A car starts from rest and moves along a circular path having a radius of 25m. Its speed increases at a uniform rate of 0.5 m/s^2. Find the time from the start and distance travelled

when its resultant acceleration becomes 1.5 m/s^2. [4]

d) Blocks $P_1 = 4N$ and $P_2 = 8N$ are connected by inextensible string. Find acceleration of the blocks. The coefficient of kinetic friction is 0.15, pulley is frictionless. [4]



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- BEE - 21/11/19

- CBSGS -

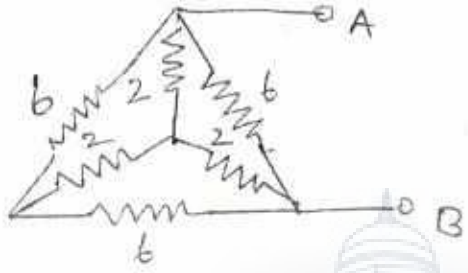
FE - Sem - I

TOTAL MARKS: 80 **TIME: 3hrs**

NB

1) Question No. 1 is compulsory.
2) Answer any three questions out of remaining five questions.
3) Assumption made should be clearly stated.
4) Answer to questions should be grouped together and written together.

Q1 a. Find R_{AB} 3



b. Find the Norton's equivalent across AB. 3

c. A pure inductor of 0.2 H is connected across single phse 200 V, 50 Hz supply. Write the instantaneous equation of voltage and current. 3

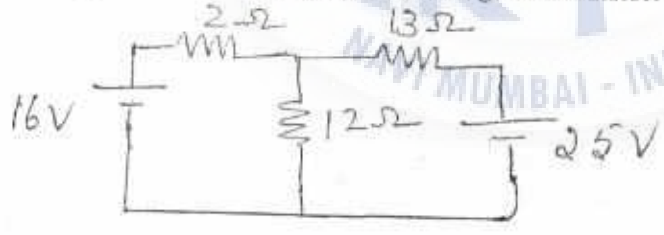
d. Write any four conditions of series resonance. 3

e. What is the phase line relation in star connected system? 2

f. Explain the working of a single phase transformer under load 4

g. Illustrate the working of half wave rectifier. 2

Q2 a. Using Mesh analysis find current through 2 Ω resistor. 6



b. The impedances (8+6) Ω and (10-j10)Ω are connected in parallel across voltage of 230∠0. Determine current in each branch and kVA, kVAR, kW and power factor of the whole circuit. 8

[TURN OVER

c. Derive emf equation of a single phase transformer 6

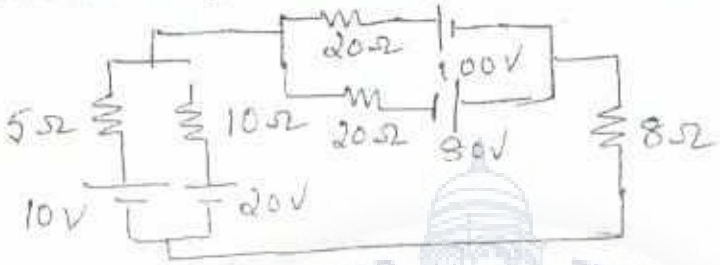
Q3 a. Calculate the phase and line currents in a balanced delta connected load taking 75 kW at a power factor of 0.8 lag from a three phase 440 V supply. Also calculate the per phase impedance. 8

b. Illustrate with neat circuit diagram the procedure for conducting open circuit test and short circuit test. 6

c. Illustrate with neat diagram and explain the input characteristics of an NPN transistor in CE configuration. 4

d. Draw the circuit diagram and output voltage waveform of a full wave rectifier with capacitor filter. 2

Q4 a. Find current through 8 Ω resistor using source transformation. 7

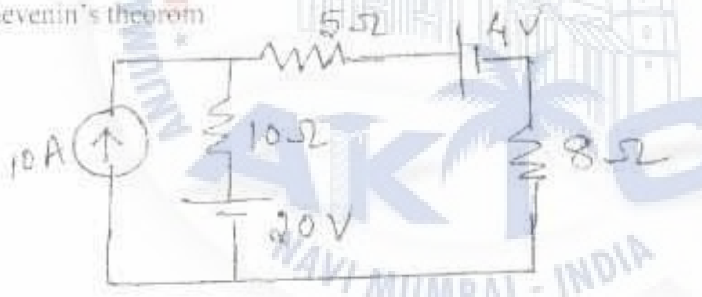


b. Three identical coils each having a resistance of 10 Ω and an inductive reactance of 10 Ω are connected in star across 400 V three phase supply. Find the reading on each of the watt meters connected to measure the power 4

c. Define the rms value of an ac quantity. 5

d. Derive rectification efficiency and ripple factor of a full wave bridge tapped rectifier. 4

Q5 a. Determine the current through 8 Ω resistor in the network using Thevenin's theorem 8



b. An rms voltage of $100\angle 0$ is applied to an impedance $Z = 20\angle 30$. Find the current through the circuit and power factor of the circuit. 4

c. Derive the conditions for maximum efficiency of a single phase transformer. 8

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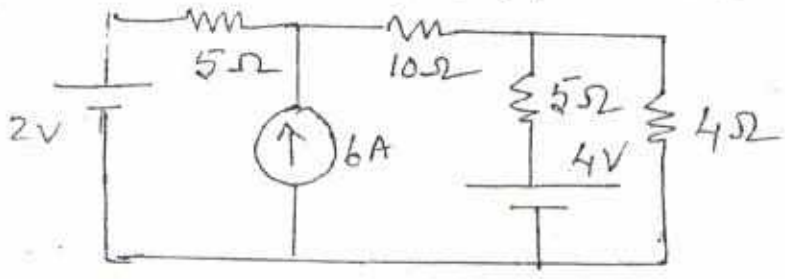
Q6 a. Find current through 4 Ω resistor using superposition theorem. 7



b. A series R-L-C circuit with R=10 Ω, L=0.014 H and C=10 μF is connected across 230V variable frequency supply. 7
Calculate a) resonance frequency b) current at resonance c) Q-factor d) voltage across inductor and capacitor and e) power factor at resonance.

c. Prove that the power and power factor in a balanced three phase circuit can be calculated from the reading of two watt meters. Draw relevant connections and phasor diagram. 6
