

2017-2018  
Mid Semester (Winter Semester) Examination  
I year B.Tech. Applied Physics (APS1110/AP111)

12 - 14

**Duration: 1 hour**

Note: i) Answer Both the questions.

ii) Symbols used have their usual meanings.

M.M. 25

1 (a) Categorize semiconductors on the basis of their composition. Generate IV-IV, II-VI and III-V binary compound semiconductors with the help of periodic table. 4.0

1(b) Discuss direct and indirect band gap semiconductors by using of E vs. k diagrams. Give five examples in each case. 5.5

1(c) Show that the probability that a state  $\Delta E$  above  $E_F$  is occupied is the same as the probability that a state that the state  $\Delta E$  below  $E_F$  is empty. 3.0

2(a) What is Compton shift? How does it support the photon nature of light? 3.0

2(b) A positron collides head on with an electron and both are annihilated. Each particle had a kinetic energy of 1.00 MeV. Find the wavelength of resulting photons. OR

2(b') X-ray of  $1.0\text{ \AA}$  are scattered from a carbon block. Find the wavelength of the scattered beam in a direction making  $90^\circ$  with the incident beam. How much kinetic energy is imparted to the recoiling electron? 3.0

2 (c) Differentiate phase and group velocities. Explain why the de Broglie phase velocity has no physical significance? 4.

2(d) Describe how X-rays wavelength may be measured? \*

Given:  $m = 9.1 \times 10^{-31}\text{ kg}$ ,  $\hbar = 6.63 \times 10^{-34}\text{ J-sec}$ ,  $e = 1.602 \times 10^{-19}\text{ C}$ ,  $C = 3.0 \times 10^8\text{ m/s}$

OR

10

Attempt all the questions.

Notations have their usual meanings.

Max. marks: 25

Q 1a Define any five of the following terms: [5x1]

- i) Strength
- ii) Homogeneity
- iii) Isotropy
- iv) Hardness
- v) Hook's law
- vi) Poisson's ratio

Q 1b Derive the relationship between Young's Modulus & Modulus of Rigidity. [5]

Q 2a For a given state of stress on a mild steel cube of size 100 mm, determine change in the volume after the application of load as shown in Fig. 1. Take  $E = 200 \text{ GPa}$ ,  $\nu = 0.3$  [6]

Q 2b A tapered circular rod of length  $L$ , is subjected to load  $P$  at one end and fixed at the other. Show that the elongation in the length of the bar is  $\delta = PL/(\pi Er_2 r_1)$ . If the bar is made up of 6061-T6 aluminium (Young's modulus,  $E_{al} = 68.9 \text{ GPa}$ ), and  $r_2 = 200 \text{ mm}$ ,  $r_1 = 100 \text{ mm}$ ,  $L = 1 \text{ m}$  and  $P = 100 \text{ kN}$ , calculate the elongated length. (Fig. 2) [9]

OR

Q 2b' Segments  $AB$ ,  $BC$  and  $CD$  are joined together and subjected to axial forces as shown in Fig. 3. If segments  $AB$  and  $CD$  are made up of mild steel and  $BC$  is made up of aluminium, calculate the value of unknown load  $P$  and total elongation of the assembly. Take  $E_{steel} = 200 \text{ GPa}$  and  $E_{aluminum} = 67 \text{ GPa}$  [6]

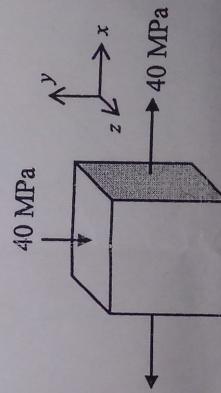


Fig. 1

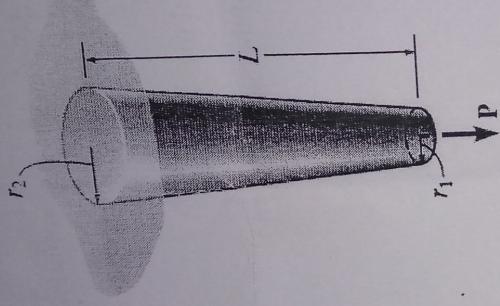


Fig. 2

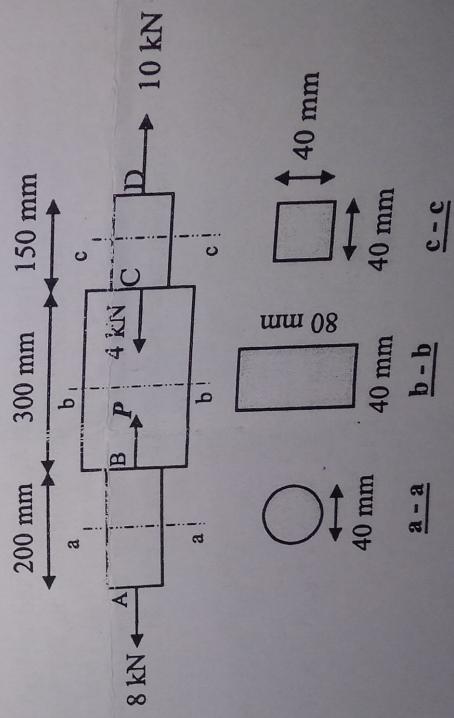
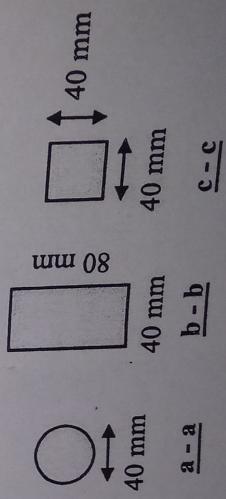


Fig. 3

D. O. C



Roll No. **17P100**

**Mid-Semester Examination-2017-18**  
**Engineering Mechanics (MEA-1120)**

**I Year B. Tech. / B. Arch. (Winter Semester)**

10-12

**Time: One Hour**

**Answer all the questions.**

**Assume suitable data if missing.**

**Notations used have their usual meaning.**

**Programmable calculators (with extra memory storage) are not permitted.**

**Q. 1 Attempt ALL questions:**

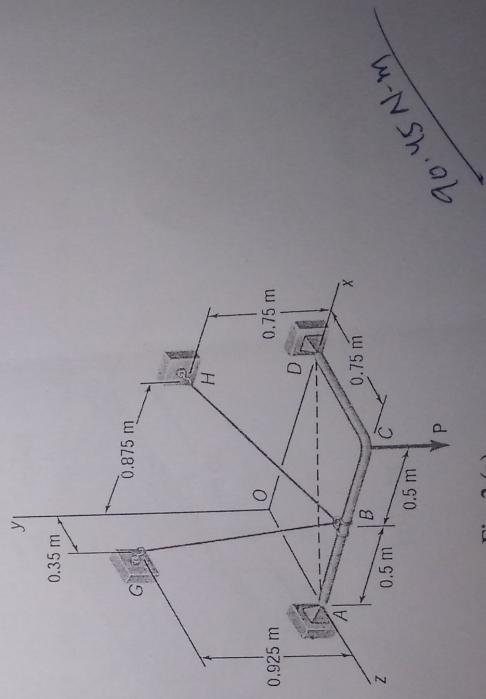
- Component of force at right angles to its direction will be  $\sin \theta$ .....
- A couple is a free vector.
- If the resultant of two equal forces has the same magnitude as either of the forces, then the angle between the two forces is  $120^\circ$ .....
- If a two dimensional structure is supported by two pinned support, it is said to be fractile.....
- In a three dimensional structure there are 9 force components and 3 couples acting on a fixed support.

**1x5=5**

**Q. 2 Attempt ANY TWO questions:**

- The frame ACD is hinged at A and D and is supported by a cable that passes through a ring at B and is attached to hooks at G and H. Knowing that the tension in the cable is 450 N, determine the moment about the diagonal AD of the force exerted on the frame by portion BH of the cable.

**2x10=20**



**Fig. 2 (a)**

- (b) A blade held in a brace is used to tighten a screw at A. (a) Determine the forces exerted at B and C, knowing that these forces are equivalent to a force couple system at A consisting of  $R = -(30 \text{ N})i + R_yj + R_zk$  and  $M_A^R = -(12 \text{ N.m})i$ . (b) Find the corresponding values of  $R_y$  and  $R_z$ .

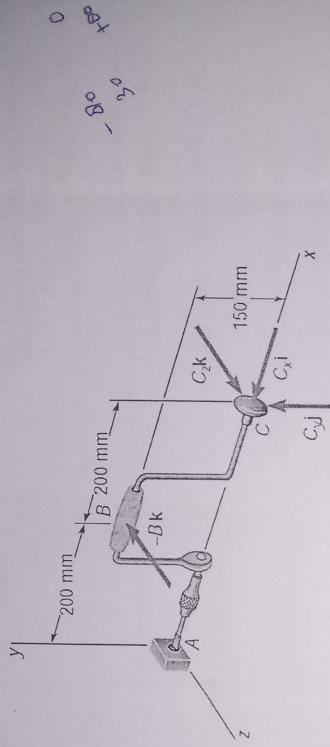


Fig. 2 (b)

- (c) The rectangular plate shown weighs 75 N and is held in the position shown by hinges at A and B and by cable EF. Assuming that the hinge at B does not exert any axial thrust, determine (a) the tension in the cable, (b) the reactions at A and B.

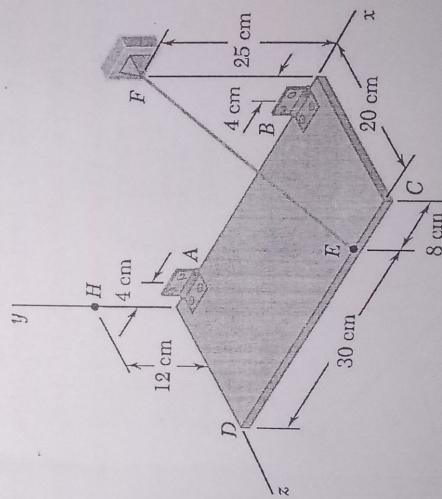


Fig. 2(c)

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Mid-Semester Examination

Session: 2017-18 (Winter Semester)

13-16

Course: Principles of Electronics Engineering (ELA-1110)

Semester: II

Duration: 1 Hours

Maximum Mark: 25

- Answer all questions.

- Assume suitable data if missing.

- Notations and symbols used have their usual meaning.

Q1(a): Draw the equivalent circuits and characteristics of a PN junction diode for piecewise linear model, the constant voltage drop model and ideal diode model.

Q1(b): Calculate the diode current for  $n=1$ ,  $I_s=10 \text{ nA}$ , and the applied voltage  $V_D=0.70 \text{ Volts}$  at room temperature. [4+4=8 marks] [CO-I]

Q2(a): Explain the difference between avalanche and zener breakdown mechanism?

Q2(b): Analysis the circuit shown in Figure 1, and calculate the current in the diodes  $D_1$  and  $D_2$ . Assume Si diodes. [3+4=7 Marks] [CO-I]

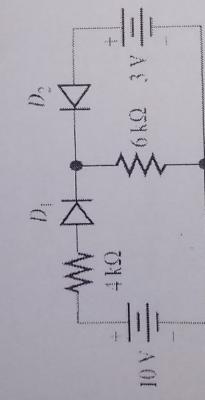


Figure 1: Problem 2(b)

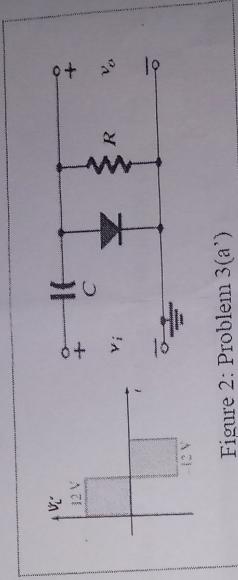


Figure 2: Problem 3(a)

Q3(a): Design a diode based circuit that clips the positive half cycle of the input sinusoidal signal.

OR

Q3(a'): Determine  $v_o$  of the network for the input  $v_i$  as shown in Figure 2.

Q3(b): Determine  $v_o$  and the required PIV rating of each diode for the configuration of Figure 3.

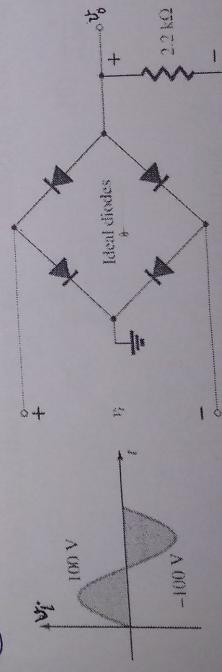


Figure 3: Problem 3(b)

[5+5=10 Marks] [CO-I]

Q. 1(a) (i) if  $u = \sec^{-1} \frac{x^3+y^3}{x+y}$ , find the value of  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ .  
 (3) =  
 (CO1)

(ii) If  $x = r \cos \theta$ ,  $y = r \sin \theta$ , then prove that  
 (5) =

$$\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial y}\right)^2 = \left(\frac{\partial u}{\partial r}\right)^2 + \frac{1}{r^2} \left(\frac{\partial u}{\partial \theta}\right)^2. \quad (\text{CO1})$$

Q. 1(b) Expand  $\sin(xy)$  near the points  $(1, \frac{\pi}{2})$  using Taylor's Theorem up to second order term.  
 (CO1)

OR

Q. 1(b') Determine the points where the function  $x^3 + y^3 - 3axy$  has a maximum or minimum.  
 (5)  
 (CO1)

Q. 2(a) Find Laplace Transform of the function  $F(t)$ ,  
 (6) =

$$F(t) = \begin{cases} \sin t, & 0 \leq t < \pi \\ 0, & t \geq \pi \end{cases} \quad (\text{CO3})$$

Q. 2(b) Find the inverse Laplace Transform of the following functions  
 (6) =

$$(i) \frac{3s-2}{s^2-4s+20} \quad (ii) \frac{1}{s^2(s^2+1)} \quad (\text{CO3})$$

OR

Q. 2(b') Evaluate the following functions  
 (6)  
 (CO3)

$$(i) L[t^2 \sin at] \quad (ii) L^{-1} \left[ \frac{s}{(s-1)(s^2+1)} \right]$$

Time One Hour

Attempt all questions

✓ Q1 Read the following carefully and critically and write précis of the same. Also suggest an appropriate title.

India is the second most populous nation in the world with a burgeoning section of its youth looking for employment opportunities. A dream career in medicine and engineering attracts the majority of students coming from the middle class or the lower economic stratum. A highly competitive environment is created among students to qualify in the NEET and IIT examinations. They toil for years for success, but with limited seats and larger number of students, a majority of them are not selected. Peer pressure, less pondered dreams, expectations of parents and a fear of failure traps them in the quagmire of success and failure. A belief prevails in society that a person who is not in these dream jobs is less human than the selected ones.

Success in Indian society is measured by the name and fame that a person acquires rather than the creativity, interests or moral and sensitive personality. Hence, a lot of students feel dejected and keep trying in these examinations till they are completely exhausted of the budding energy in them. It appears that selection after toiling hard for years in competitive examinations will open the doors of happiness forever. They keep trying for years to get selected much to their emotional and mental detriment. The question that arises here is whether these competitions actually bring the best out of any students in India. Is competition killing creativity in the youth?

Competitive examinations in India are more goal-oriented than process-oriented. Students work for results and are deeply attracted to the name associated with selection in these examinations. In this way, the interests and creativity of a student are replaced by the dream of selection in these examinations. They do not ponder on the process in which they will get into once the fuss associated with the examination is over.

A doctor has to treat patients after being selected. However, with the focus on the goals, a failure shatters the lives of thousands of students. One has to understand that it is only an examination created by us humans and not a divine will. Society needs people with different skills in different jobs. One's failure does not mean the end of life. Success to people has come in the most unexpected ways and not always in a career which they aspired from childhood. Therefore, one should not become a prisoner to one's own thoughts but accept failure as a part of life and move on.

W-11  
MM/25

Page 1 of 6	Page No.	10 (c) 1	Marks	10 (c) 1
Comments *				

Q2 Write a critical essay (in about 400 words) on any one of the following. (10)

Human sources of error in scientific research

The division between theoretical and applied science is artificial

Scientific attitude and democracy

Q3 Briefly explain any one of the following.

✓ Human mind is like an instrument

The problem of memory is not necessarily related with time

Q4 Write a concise report on the 65<sup>th</sup> Annual Convocation at AMU. (5)

OR

✓ Identify and correct the error in the following sentences.

He has always been very kind with his neighbours

They were not aware of that it was so late.

She found the book laying open on her table.

The candidate replied he did not intend to stand for election. *he* ~~that~~ <sup>that</sup> ~~he was not intended to~~

Too many books has been written by him about the last war.

*have*