

2018-19

**B. TECH. (AUTUMN SEMESTER) EXAMINATION**  
**All branches**  
**APPLIED CHEMISTRY**  
**ACS-1110/AC-111**

**Maximum Marks: 60****Credits: 04****Duration: Two Hours***Answer all questions.**Assume suitable data if missing.**Notations and symbols used have their usual meaning.*

<b>Q.No.</b>	<b>Question</b>	<b>CO</b>	<b>M.M.</b>
<b>1(a)</b>	What are ion-exchange resins? Discuss the mechanism of water softening using ion-exchange resins.	(CO1)	[04]
<b>1(b)</b>	A sample of water contains following impurities: $Mg(HCO_3)_2 = 70 \text{ mg/L}$ ; $CaCl_2 = 219 \text{ mg/L}$ ; $MgSO_4 = 117 \text{ mg/L}$ ; $Ca(NO_3)_2 = 161 \text{ mg/L}$ . Calculate the quantity of lime (74% pure) and soda (90% pure) needed for softening 5,000 L of water. Also calculate temporary, permanent and total hardness.(Atomic weights: Mg = 24; Ca = 40; N = 14; C = 12; O = 16; H = 1; Cl = 35.5; S = 32).	(CO1)	[06]
<b>1(c)</b>	Discuss the different reasons for boiler corrosion and how it is controlled?	(CO1)	[05]

**OR**

<b>1(c)'</b>	Write notes on the followings:	(CO1)	[2.5x2]
	(i) Breakpoint chlorination		
	(ii) Sedimentation with coagulation		
<b>2(a)</b>	What are fuels? Write down the characteristics of a good fuel.	(CO2)	[03]
<b>2(b)</b>	Calculate the gross and net calorific values of coal having the following compositions: Carbon= 81%, Hydrogen= 11 %, Nitrogen= 3%, ash= 3%, Sulphur = 2%. (Latent heat of steam=587cal/g)	(CO2)	[04]

Contd....2.

- 2(c) Define the term cracking. Discuss the process of fixed bed catalytic cracking. (CO2) [05]

**OR**

- 2(c)' What are blended oils? Discuss different types of additives in blended oils. (CO2) [05]

- 2(d) What are greases? How are they prepared? (CO2) [03]

- 3(a) Discuss the mechanism of dry corrosion. Give the types of oxide films formed on the metal surface. (CO3) [04]

**OR**

- 3(a') Differentiate between electrochemical and galvanic series. (CO3) [04]

- 3(b) Calculate the emf of a Daniel cell at 25°C, when the concentration of  $ZnSO_4$  and  $CuSO_4$  are 0.001M and 0.1M respectively. The standard potential of the cell is 1.1V. (CO3) [02]

- 3(c) Write short notes on **any three** of the followings: (CO3) [3x3]

- (i) Requirements of good paint
- (ii) Cathodic protection by sacrificial anode method
- (iii) Constituents of varnish
- (iv) Galvanizing

- 4(a) What is vulcanization? Write down its advantages. (CO4) [04]

- 4(b) Discuss the preparation, properties and uses of **any two** of the following polymers: (CO4) [4x2]

- (i) PVC
- (ii) Nylon-6,6
- (iii) Neoprene

- 4(c) Discuss the anionic mechanism of polymerization. (CO4) [03]
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2018-19

**B.TECH. (AUTUMN SEMESTER) EXAMINATION  
(ALL BRANCHES)  
MATHEMATICS - I  
AM-111**

**Maximum Marks: 60****Credits: 04****Duration: Two Hours**

Note: (i) Attempt all questions.

(ii) Symbols have their usual meanings.

(iii) Marks allotted to each question and course outcome (CO) covered are indicated against each question.

<b>Q.No.</b>	<b>Question</b>	<b>CO</b>	<b>Mark</b>
1(a)	Show that the equations	CO1	[07]

$$3x + 4y + 5z = a, \quad 4x + 5y + 6z = b, \quad 5x + 6y + 7z = c$$

do not have a solution unless  $a + c = 2b$ . Solve the equations when  $a = b = c - 1$ .

1(b)	Find $A^{-1}$ using Cayley-Hamilton Theorem for the matrix	CO1	[08]
$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$			

Also express  $A^6 - 6A^5 + 9A^4 - 2A^3 - 12A^2 + 23A - 9I$  as linear polynomial in A and evaluate it.

**OR**

1(b')	Find all the eigenvalues and eigenvectors of the matrix	CO1	[08]
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$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$$

2(a)	Find the asymptotes of the curve $x^3 - 2y^3 + xy(2x - y) + y(x - 1) + 1 = 0$ .	CO2	[08]
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**OR**

2(a')	Giving all salient features trace the curve $y^3 = a^2x - x^3$ .	CO2	[08]
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2(b)	If $y = a \cos(\log x) + b \sin(\log x)$ , show that	CO2	[07]
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$$x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2 + 1)y_n = 0.$$

3(a)	If $s$ be the length of the arc of the catenary $y = c \cosh(x/c)$ from the vertex $(0, c)$ to the point $(x, y)$ , show that $s^2 = y^2 - c^2$ .	CO3	[07]
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contd...-2

- 3(b) Find the volume of the spindle shaped solid generated by revolving the astroid  $x^{2/3} + y^{2/3} = a^{2/3}$  about the  $x$ -axis. CO3 [08]

OR

- 3(b') Find the area of the surface formed by the revolution about the  $x$ -axis of an arch of the cycloid  $x = a(\theta + \sin \theta)$ ,  $y = a(1 + \cos \theta)$ . CO3 [08]

- 4(a) Solve the following differential equations: CO4 [08]

$$(i) \frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = x + \sin x.$$

$$(ii) \frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 + 2x + 4.$$

OR

- 4(a') Solve the simultaneous differential equations CO4 [08]

$$\frac{dx}{dt} + 2y + \sin t = 0,$$

$$\frac{dy}{dt} - 2x - \cos t = 0.$$

- 4(b) Radium disintegrates at a rate proportional to the amount present. If the half period is 1600 years, i.e. if half the original amount disintegrates in 1600 years, find the percentage remaining after 100 years. CO4 [07]
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**2018-19**  
**B. TECH. (AUTUMN SEMESTER) EXAMINATION**  
**ALL BRANCHES**  
**MATHEMATICS-II**  
**AM-112**

**Maximum Marks: 60****Credits: 04****Duration: Two Hours***Answer all questions.**Assume suitable data if missing.**Notations and symbols used have their usual meaning.*

<b>Q.No.</b>	<b>Question</b>	<b>CO</b>	<b>M.M.</b>
<b>1(a)</b>	If $u = \sin^{-1} \frac{x+y}{\sqrt{x+y}}$ , find the value of $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$ .	(CO1)	[7.5]
<b>OR</b>			
<b>1(a')</b>	If $z = f(x, y)$ where $x = e^u \cos v, y = e^u \sin v$ , show that $\left(\frac{\partial z}{\partial u}\right)^2 + \left(\frac{\partial z}{\partial v}\right)^2 = e^{2u} \left\{ \left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 \right\}$ .	(CO1)	[7.5]
<b>OR</b>			
<b>1(b)</b>	If $u = \frac{x+y}{1-xy}$ and $v = \tan^{-1} x + \tan^{-1} y$ . Are $u$ and $v$ functionally related? If so, find the relationship.	(CO1)	[7.5]
<b>2(a)</b>	Expand $e^x \log(1+y)$ in powers of $x$ and $y$ upto terms of third degree.	(CO2)	[07]
<b>2(b)</b>	Divide 24 into three parts such that the continued product of the first, square of the second and cube of the third may be maximum.	(CO2)	[08]
<b>OR</b>			
<b>2(b')</b>	The temperature $T$ at any point $(x, y, z)$ in space is $T = 400xyz^2$ . Find the highest temperature on the surface of the unit sphere $x^2 + y^2 + z^2 = 1$ .	(CO2)	[08]
<b>3(a)</b>	Find by double integration, the area lying inside the circle $r = a \sin \theta$ and outside the cardioid $r = a(1 + \cos \theta)$ .	(CO3)	[07]
<b>OR</b>			
<b>3(a')</b>	Show by double integration that the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is $\frac{16}{3}a^2$ .	(CO3)	[07]

Contd... 2.

- 3(b) Find the volume cut from the sphere  $x^2 + y^2 + z^2 = a^2$  by the cone  $x^2 + y^2 = z^2$ . (CO3) [08]
- 4(a) Trace the conic  $16x^2 - 24xy + 9y^2 + 77x - 64y + 95 = 0$ . Find the coordinates of focus and length of latus-rectum. (CO4) [08]
- 4(b)  $PSP'$  and  $QSQ'$  are two perpendicular focal chords of a conic, prove that (CO4) [07]  
 $\frac{1}{SP \cdot SP'} + \frac{1}{SQ \cdot SQ'}$  is constant.

OR

- 4(b') A circle of given radius passing through the focus  $S$  of a given conic intersects it in the points  $A, B, C$  and  $D$ . Show that  $SA \cdot SB \cdot SC \cdot SD$  is constant.
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2018-19

**B.TECH. (AUTUMN SEMESTER) EXAMINATION  
(ALL BRANCHES)  
APPLIED MATHEMATICS - I  
AMS-1110**

**Maximum Marks: 60****Credits: 04****Duration: Two Hours**

Note: (i) Attempt all questions.

(ii) Symbols have their usual meanings.

(iii) Marks allotted to each question and course outcome (CO) covered are indicated against each question.

Q.No.	Question	CO	Marks
1(a)	Let $V$ be the set of all ordered pairs $(x, y)$ in $\mathbb{R}^2$ with vector addition defined as $(x_1, y_1) + (x_2, y_2) = (2x_1 + 3x_2, y_1 + y_2)$ and the scalar multiplication as $\alpha(x_1, y_1) = (\alpha x_1, \alpha y_1)$ . Show that $V$ is a vector space.	CO1	[07]

1(b)	Examine whether the matrix $A$ is diagonalizable. If so obtain the matrix $P$ such that $P^{-1}AP$ is a diagonal matrix	CO1	[08]
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$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$$

**OR**

1(b')	Find the characteristic equation of the matrix	CO1	[08]
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$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$$

and hence compute  $A^{-1}$ . Also find the matrix represented by  $A^8 - 11A^7 - 4A^6 + A^5 + A^4 - 11A^3 - 3A^2 + 2A + I$ .

2(a)	Expand $e^{m \cos^{-1} x}$ by Maclaurin's Theorem upto the third power of $x$ .	CO2	[08]
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**OR**

2(a')	Trace the curve $y^2(a - x) = x^2(a + x)$ giving its all salient features.	CO2	[08]
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2(b)	Test the convergence of the series:	CO2	[07]
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$$\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \frac{x^6}{5\sqrt{4}} + \dots$$

Contd... 2.

- 3(a) Show that the intrinsic equation of the parabola  $y^2 = 4ax$  is CO3 [07]

$$s = a \cot \psi \cosec \psi + a \log(\cot \psi + \cosec \psi).$$

- 3(b) The area bounded by the parabola  $y^2 = ax$  and its latus rectum, is revolved about its directrix. Find the volume of the solid generated. CO3 [08]

OR

- 3(b') Find the area of the surface of the solid formed by revolving the cardioid CO3 [08]

$$r = a(1 + \cos \theta)$$
 about the initial line.

- 4(a) Solve any two of the following differential equations: CO4 [08]

(i)  $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 8(e^{2x} + \sin 2x + x^2)$

(ii)  $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 3 \sin x + 4 \cos x, y(0) = 1$  and  $y'(0) = 0$ .

(iii)  $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \log x$ .

- 4(b) The initial value problem governing the current  $i$  flowing in a series  $RL$  circuit when CO4 [07]

a voltage  $V(t) = t$  is applied, is given by  $iR + L \frac{di}{dt} = t, t \geq 0, i(0) = 0$ , where

$R$  and  $L$  are constants. Find the current  $i(t)$  at time  $t$ .

2018-19

**B. TECH. (AUTUMN SEMESTER) EXAMINATION**  
**(Civil/Chemical/Computer/Electrical/Electronics/Mechanical/Petro-Chemical)**  
**APPLIED PHYSICS**

APS-1110/AP-111

**Maximum Marks: 60****Credits: 04****Duration: Two Hours***Attempt all questions.**Notations and symbols have their usual meaning.*

<b>Q.No.</b>	<b>Question</b>	<b>CO</b>	<b>M.M.</b>
1(a)	What is Hall effect? Mention its two applications.	(CO1)	[03]
1(b)	Obtain the expressions for electron and hole concentrations in a semiconductor assuming that most of the charge carriers lie near the conduction and valance band edges.	(CO1)	[06]
1(c)	For a semiconductor $\mu_n = \mu_p = 1000 \text{ cm}^2/\text{Vs}$ and $N_c = N_v = 10^{19} \text{ cm}^{-3}$ . If the conductivity of the intrinsic semiconductor at 300K is $4 \times 10^{-6} \Omega^{-1} \text{ cm}^{-1}$ , what is the conductivity at 600K?	(CO1)	[06]
2(a)	Draw the block diagram of an optical fibre communication system showing all its important parts. Mention the advantages of communication using optical fibre.	(CO2)	[05]
<b>OR</b>			
2(a')	Define the numerical aperture and acceptance angle of an optical fibre and obtain mathematical expressions for them.	(CO2)	[05]
2(b)	Explain the terms: meta-stable state, population inversion, stimulated emission and pumping.	(CO2)	[04]
<b>OR</b>			
2(b')	Mention important characteristics and applications of laser.	(CO2)	[04]
2(c)	Give the construction of a ruby laser and explain its working. A ruby laser emits pulses of 0.8 J. There are $2.8 \times 10^{18}$ active ions of $\text{Cr}^{3+}$ in the ruby. Calculate the wavelength of emitted light.	(CO2)	[06]
<b>OR</b>			
2(c')	With the help of suitable diagrams explain the working of a semiconductor laser.	(CO2)	[06]

Contd... 2

- 3(a) Mention the use of X rays in science and medicine. Find the maximum frequency of emitted X rays, when the applied voltage across the X ray tube is 40 kV. (CO3) [03]
- OR**
- 3(a') Why the Compton effect can't be observed by the visible light? Calculate the change in wavelength of incident and scattered photons, if the X ray photons are scattered at angles  $45^\circ$ ,  $90^\circ$  and  $180^\circ$ . (CO3) [03]
- 3(b) Write the operator corresponding to physical quantities; position ( $x$ ), momentum ( $p$ ), kinetic energy (KE) and total energy ( $E$ ). Solve the Schrodinger equation for a particle in a box of width L. (CO3) [06]
- OR**
- 3(b') What do you mean by the phenomenon of pair production and pair annihilation? Show that pair production can't occur in empty space. (CO3) [06]
- 3(c) State uncertainty principle. A typical atomic nucleus is about  $5.0 \times 10^{-15}$  m in radius. Use uncertainty principle to place a lower limit on the energy an electron must have if it is to be part of a nucleus. (CO3) [06]
- OR**
- 3(c') Electrons with energies of 1.0 eV and 2.0 eV are incident on a barrier 10.0 eV high and 0.50 nm wide. (i) Find their respective transmission probabilities. (ii) How are these affected if the barrier is doubled in width? (CO3) [06]
- 4(a) Compare all three kinds of statistical distribution functions. Show that average kinetic energy of a gas molecule in equilibrium at absolute temperature T is  $3/2 kT$ . (CO4) [08]
- 4(b) Discuss Dulong-Petit law? Obtain Einstein's formula for specific heat of solids. (CO4) [07]

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**Some Useful Physical Constants**

$$h = 6.63 \times 10^{-34} \text{ J.s}, \quad k = 1.38 \times 10^{-23} \text{ J/K}, \quad m_e = 9.1 \times 10^{-31} \text{ kg}, \quad m_p = 1.67 \times 10^{-27} \text{ kg}, \quad c = 3 \times 10^8 \text{ m/s}$$
$$n_i(\text{Si at } 300\text{K}) = 1.5 \times 10^{10} \text{ cm}^{-3}, \quad n_i(\text{Ge at } 300 \text{ K}) = 2.5 \times 10^{13} \text{ cm}^{-3}$$

**2018-19**  
**B.ARCH. (AUTUMN SEMESTER) EXAMINATION**  
**B. ARCH I- YEAR**  
**PRINCIPLES & PHILOSOPHY OF ARCHITECTURE**  
**ARC-1010**

**Maximum Marks: 60****Credits: 04****Duration: Two Hours***Answer all the questions.**Draw sketches to support your answer.*

<b>Q.No.</b>	<b>Question</b>	<b>M.M.</b>
<b>1</b>	Define the term architecture, explain the future scope of architecture in India?	[10]
	OR	
<b>1'</b>	How the role of an architect is changing with time, explain the role and responsibility of an Architect in present Indian context?	
<b>2</b>	How plane,as an element,is important in architecture, explain with neat sketch the different type of planes used in architecture?	[10]
	OR	
<b>2'</b>	What are the different principles of architecture, explain hierarchy and balance with suitable examples?	
<b>3</b>	What are warm and cool colours, explain with suitable examples how change in colour affects the human psychology?	[10]
<b>4</b>	Explain with neat sketches how styles play an important role throughout the history in influencing the architecture?	[15]
<b>5</b>	Define in brief about Architect Zaha Hadid and her philosophy, explain with neat sketch one of the building designed by her and also explain how she had incorporated her philosophy in designing that building?	[15]

2018-19  
**B.ARCH. (FIRST SEMESTER) EXAMINATION**  
**Architectural Drawing -I**  
**ARC 1310**

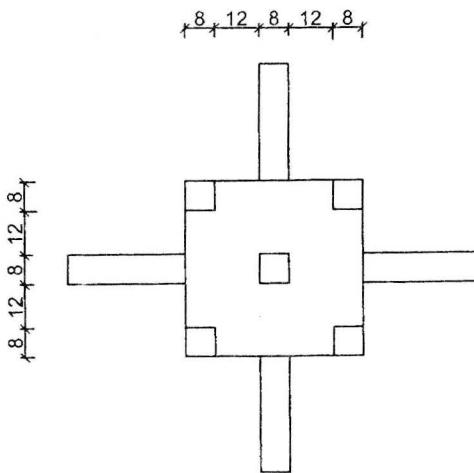
Maximum Marks: 40

Credits: 3

Duration: 3 Hours

*Answer all the questions.**Assume suitable data if missing.**All dimensions are in mm.**Neat and good drafted drawings will be credited more.*

Q.No.	Question	M.M.
1	A regular pentagonal pyramid with the sides of its base 30mm and height 75mm rests on an edge of the base on H.P. The base is tilted until its apex is 50 mm above the level of the edge of the base on which it rests. Draw orthographic projections of the pyramid when the edge on which it rests, is parallel to the V.P. and the apex of the pyramid is pointed towards the V.P.	[10]
OR		
1'	Draw orthographic projections of a cube of side 30 mm resting on ground on one of its corner in such a way that one of its solid diagonal in perpendicular to V.P.	
2	Draw development of surface of a sphere of radius 20 mm.	[10]
3	A square pyramid, base 40 mm side and axis 70 mm long, has its base on the H.P. and all the edges of the base equally inclined to the V.P. It is cut by a sectional plane, perpendicular to the V.P., inclined at $45^0$ to the H.P. and bisecting the axis. Draw its sectional top view and true shape of the section.	[10]
4	Draw isometric view of the object shown in figure-1	[10]



(All Dimensions are in mm)

PLAN & ALL ELEVATIONS  
FIGURE-1

2018-2019

**B.ARCH. (WINTER SEMESTER) EXAMINATION  
BASIC DESIGN AND VISUAL APPRECIATION AR~~C~~1610**

**Maximum Marks: 40****Credits: 07****Duration: Four Hours**

*First two questions are compulsory with distinctive choice and weightage as mentioned. Present and render them in medium of your choice giving adequate time, from within the allotted four hours, for drying if water or poster colours used. Concept shall be evaluated through Viva Voce. Answer any three questions from Question No. 3 to Question No. 6 carrying 4 marks each. Illustrate these with relevant examples and sketches. Give time commensurate to the allotted marks of each question attempting them sequentially from one to six.*

- 1** Describe any one daily need object and write about good and bad attributes about the design of that object. Redesign the object eliminating the bad attributes and illustrate the design with the help of sketches, drawings etc. [20]

**OR**

- 1'** Aligarh Muslim University is a Central University with large campus. There are two major entrances for the University namely Bab-e-Syed and entrance gate from Purani Chungi area. Design a gated entrance for the Aligarh Muslim University Campus from the Purani Chungi area (45m wide Anoopshahr Road). The designed gated entry **on the** 30 m wide AMU road should accommodate security post and an announcement booth giving adequate entrance bay/recess for the slowing down traffic. Present your scheme through:  
 PLAN(S) MM 06, ELEVATION(S) MM 04 ,SECTION(S) MM 04 AND VIEW(S)  
 AND CONCEPT MM 06 [20]

- 2** Design a logo for Architecture Alumni Association, Department of Architecture, AMU inscribed in a square of 150 mm x 150mm. [08]
- 3** What are the responsibilities of an architect and describe the role of COA and IIA in the field of architecture? [04]
- 4** What are the various steps involved in the process of design and its relevance to a designer? [04]
- 5** Write a short note on any building from Aligarh city describing its architecture in your visual perspicacity. [04]
- 6** What is design? Write the importance of visual appreciation in the field of architecture? [04]

2018-19

**B.TECH. (AUTUMN SEMESTER) EXAMINATION****CIVIL ENGINEERING****CEA-1110/CE111****ENVIRONMENTAL STUDIES****Maximum Marks: 60****Credits: 04****Duration: Two Hours***Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.***Q.No.****Question****M.M.****Section 'A'**

- 1 (a)** Define Ecosystem? What are the classification of Ecosystem? Explain briefly about (7)  
structure and function of an Ecosystem?

**OR**

- 1 (a)** Discuss in detail the components of Desert Ecosystem (7)
- 1 (b)** Describe the composition of municipal solid wastes. What are the functional (7)  
elements of solid waste management?
- 2 (a)** Answer any **TWO** of the following: (3x2)
- (a) Write short notes on Floods?
  - (b) Primary and Secondary pollutants with example?
  - (c) Explain briefly about Food chain and Food web?

**Section 'B'**

- 2 (b)** Answer any **TWO** the following: (3 x 2)
- (a) Define biodiversity. What are the main threats to biodiversity?
  - (b) How is biodiversity affected by human activity? Why must we conserve  
biodiversity?
  - (c) Explain the characteristics of different biographic zones of India.
- 2 (c)** What are the main goals of water conservation? Discuss the important measures to (7)

Contd... 2.

conserve water.

**OR**

(7)

- 2 (c) Identify and explain the core causes of water crisis in the world. Describe the impacts of over utilization of underground and surface water. What is the importance of rain water harvesting? (7)
- 3 (a) How the population density and carrying capacity are helpful to explain the population growth? Total *population of India* as per 2017 census was 1339 million. This will grow to 1628 million in 2050 census. What is the annual percentage growth rate for India? (7)

**Section 'C'**

- 3 (b) Discuss in detail about the adverse impact of modern agriculture with reference to the following: (10)
- a) Fertilizer related problems
  - b) Pesticide related problems
  - c) Water logging, and
  - d) Salinity

**'OR'**

- 3 (b) Write in detail about the exploitation of mineral resources, associated environmental problems and conservation of minerals. (10)

- 4 (a) Discuss in brief about any **One** of the following: (5)
- a) Waste land reclamation
  - c) Ozone layer depletion
- 4 (b) Write about Air (prevention and control of pollution) Act or water (prevention and control of pollution) act. (5)

**Department of Civil Engineering**  
**B. Tech. I yr., End-Semester Examination: Autumn 2018-19**  
**CEA 1120: Strength of Materials**

**Time: Two Hrs.**

**Max. marks: 60**

**Attempt all the questions.**

**Notations have their usual meanings.**

- Q 1 (a)** Find the principal stresses, the maximum shear stress and the corresponding angle of planes respectively for the state of stress shown in Fig. 1 using Mohr's circle method. [8]

- Q 1 (b)** The stress-strain diagram for an aluminum alloy that is used for making aircraft parts is shown in Fig. 2. If a specimen of this material is stressed to  $600 \text{ MPa}$ , determine the permanent strain that remains in the specimen when the load is released. Also, find the modulus of resilience both before and after the load application. [7]

**OR**

- Q 1(b')** Determine the total elongation of a steel member, when it is subjected to an axial force of  $30 \text{ kN}$ . The member is  $10 \text{ mm}$  thick. Take modulus of elasticity,  $E=200 \text{ GPa}$  (Fig. 3) [7]

- Q 2** Draw the shear force and bending moment diagrams for the beam shown in Fig. 4. [15]

**OR**

- Q 2'** Draw the shear force and bending moment diagrams for the beam shown in Fig. 5. [15]

- Q 3(a)** Derive the relationship between torque  $T$  applied on a solid circular shaft of radius  $R$  and length  $L$ , shear stress  $\tau$  and angle of twist  $\phi$ . [6]

- Q 3(b)** Determine which cross-section of beams shown in Fig. 6, will support a moment of  $150 \text{ kNm}$  about neutral axis, with the least amount of bending stress. Also calculate the value of that stress. [9]

**OR**

- Q 3(b')** The beam shown in Fig. 7 is made from two boards. Determine the maximum shear stress in the glue necessary to hold the boards together along the seam where they are joined. [9]

- Q 4 (a)** Define degree of static indeterminacy. Calculate the degree of static indeterminacy in a truss structure shown in Fig. 8. [3]

- Q 4 (b)** A truss given in Fig. 8, supported on pin joint at G and roller at A. Determine the axial forces in members. State if the members are in tension or compression. Assume all members are pin connected. [12]

Contd. . . . 2.

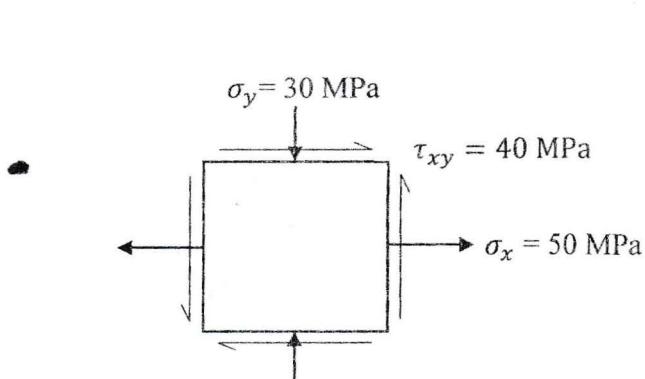


Fig. 1

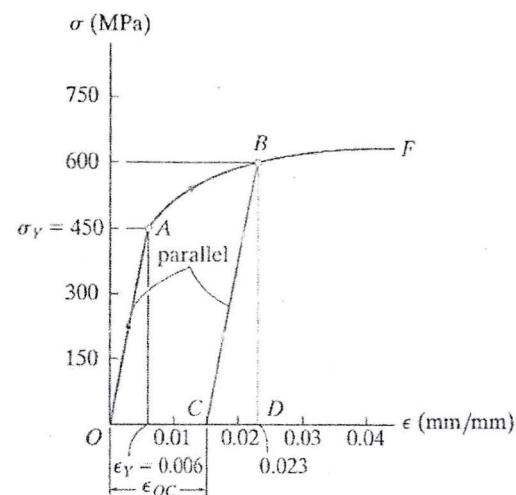


Fig. 2

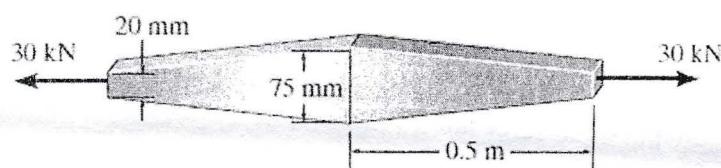


Fig. 3

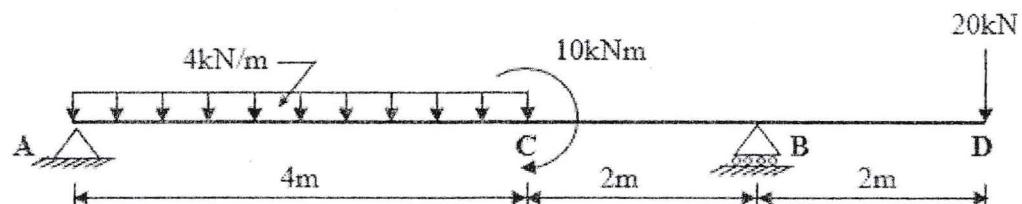


Fig. 4

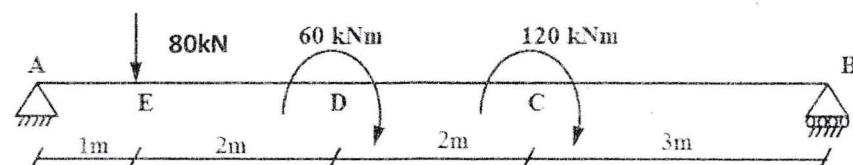


Fig. 5

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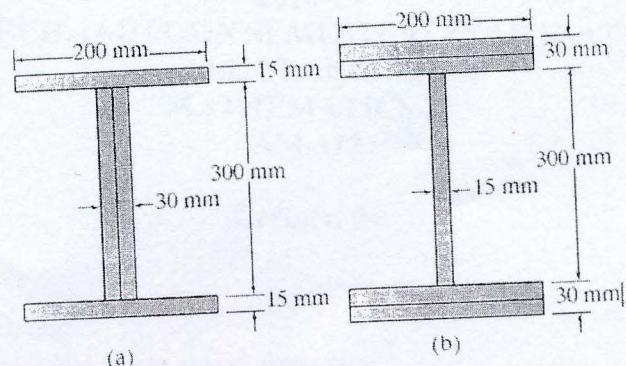


Fig. 6

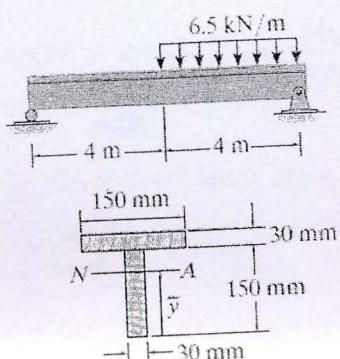


Fig. 7

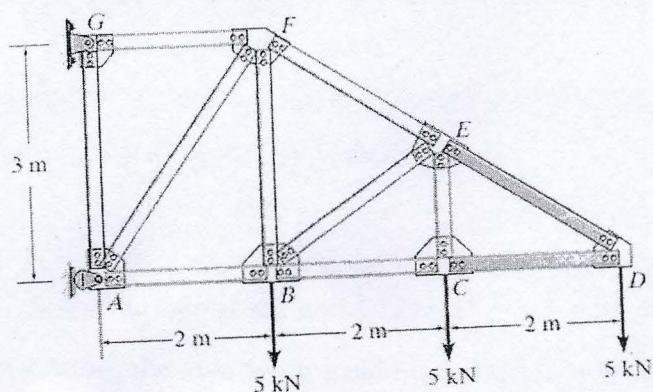


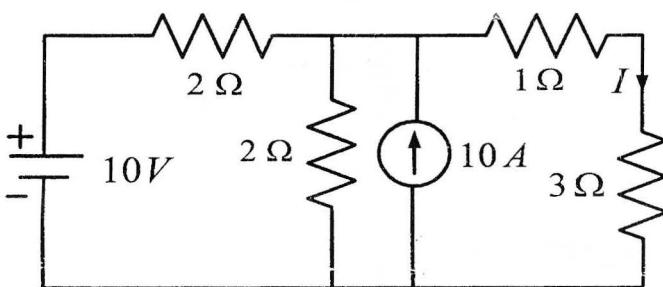
Fig. 8

2018-19

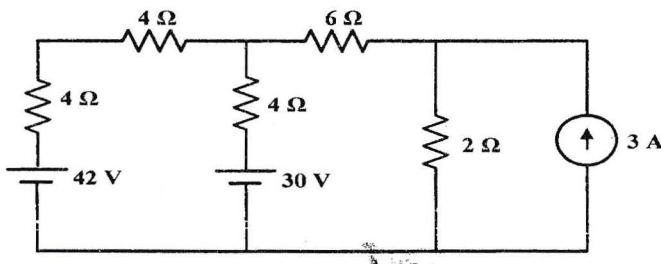
**B.TECH. (AUTUMN SEMESTER) EXAMINATION  
BASIC ELECTRICAL AND ELECTRONICS ENGINEERING  
COURSE CODE: EE-111**

**Maximum Marks: 60****Credits: 04****Duration: Two Hours***Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

Q. No.	Questions	CO	M.M.
<b>PART A</b>			
1 (a)	With the help of phasor diagram, derive the relation between line and phase voltages in star connected three phase circuit.	CO1	[07]
1 (b)	Determine the current $I$ in the network of Fig. 1 by using Thevenins theorem.	CO1	[08]

**Fig. 1****OR**

- 1(b') For the circuit shown in Fig. 2, find the current through  $6\Omega$  resistor using Superposition theorem. CO1 [08]

**Fig. 2**

- 2(a) A single phase transformer working at Unity power factor has an efficiency of 90% at both half load and at the full load of 500 Watts. Determine the efficiency at 75% full load. CO3 [05]
- 2(b) A 3 phase, 50 Hz, 4 pole induction motor has an induced emf in the rotor with a frequency of 2 Hz. Calculate CO3 [05]
- a) Synchronous Speed
  - b) Slip
  - c) Speed of the motor

contd...2.

**OR**

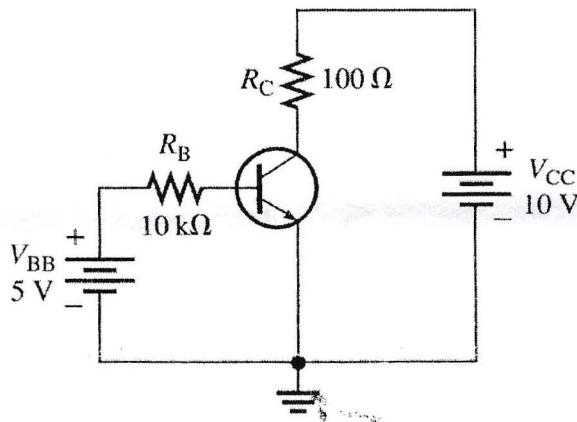
- 2(b')** With the help of a suitable diagram explain the working of a moving iron instrument. CO3 [05]
- 2(c)** With the help of a layout, briefly discuss the working of a hydro power plant. CO4 [05]

**PART B**

- 3(a)** Explain the current equation of a PN junction diode. CO5 [04]
- 3(b)** With the help of a neat diagram, explain I-V characteristics of Zener diode and how it works as a voltage regulator. CO5 [06]

**OR**

- 3(b')** Determine  $I_B$ ,  $I_C$ ,  $I_E$ ,  $V_{BE}$ ,  $V_{CE}$  and  $V_{CB}$  in the circuit of Fig. 3. The transistor has a  $\beta = 150$ . CO7 [06]



**Fig. 3**

- 3(c)** Draw the circuit diagram of a center-tapped full-wave rectifier circuit, indicating the direction of current paths during positive and negative half cycles of input. Explain its operation and determine its peak inverse voltage. CO6 [05]
- 4(a)** Explain the construction, working and characteristics of an n-channel enhancement-type MOSFET. CO5 [06]

**OR**

- 4(a')** Explain the construction, working and characteristics of an n-channel depletion-type MOSFET. CO5 [06]
- 4(b)** What are the different characteristics of an ideal operational amplifier? Also, explain the significance of virtual ground in an operational amplifier. CO5 [04]
- 4(c)** Explain the functioning of OPAMP-based inverting integrator. CO6 [05]

2018-19

**B.TECH. (AUTUMN SEMESTER) EXAMINATION  
ALL BRANCHES  
PRINCIPLES OF ELECTRICAL ENGINEERING  
COURSE CODE: EEA1110**

**Maximum Marks: 60****Credits: 03****Duration: Two Hours***Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

<b>Q. No.</b>	<b>Questions</b>	<b>CO</b>	<b>M.M.</b>
<b>1 (a)</b>	With the help of phasor diagram, derive the relation between line and phase voltages in star connected three phase circuit.	CO1	[08]
<b>1 (b)</b>	Determine the voltage across and current through the inductor in Fig. 1 using Thevenin's theorem.	CO1	[12]

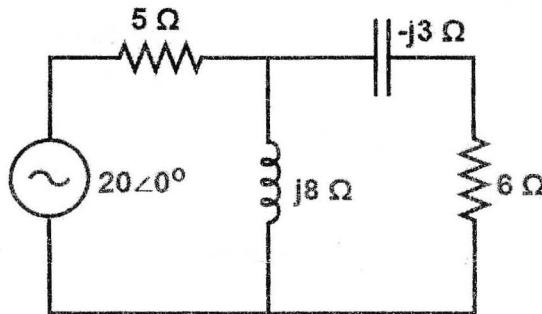
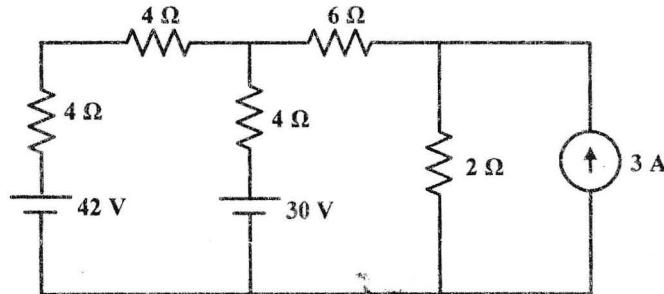


Fig. 1

OR

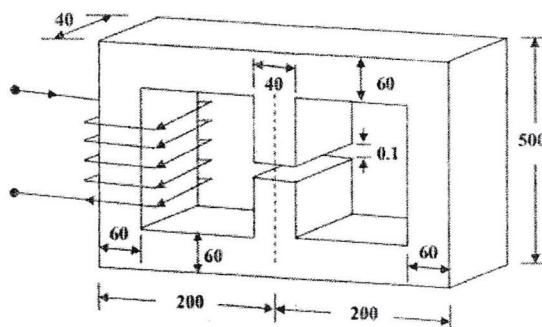
- 1'(b)** For the circuit shown in Fig. 2, find the current through  $6 \Omega$  resistor using CO1 [12] Superposition theorem.



contd ... 2 .

Fig. 2

- 2 (a) In the magnetic circuit shown in the following figure (with all dimensions in mm), calculate the required current to be passed in the coil having 200 turns in order to establish a flux of 1.28 mWb in the air gap. Relative permeability of the magnetic material is 4000.



- 2 (b) The resistances and leakage reactances of a 10 kVA, 50 Hz, 2300/230 V CO2 [10] distribution transformer are:

$$\begin{array}{ll} r_1 = 3.96 \Omega & r_2 = 0.0396 \Omega \\ x_1 = 15.8 \Omega & x_2 = 0.158 \Omega \end{array}$$

It delivers rated kVA at 0.8 pf lagging to a load on the LV side. Find

- The HV side voltage necessary to maintain 230 V across load terminals.
- The percentage voltage regulation

OR

- 2 (b) A 500 KVA, single phase transformer working at unity power factor has an CO2 [10] efficiency of 95% both at full load and 60% of full load.

- Separate out the losses of the transformer
- Determine the efficiency at 75% full load

- 3 (a) Explain how a rotating magnetic field is produced by a 3-phase stator CO3 [10] winding supplied with 3-phase ac supply.

OR

- 3 (a) Draw a single line diagram of power system and explain it briefly. CO3 [10]

- 3 (b) With the help of a layout, briefly discuss the working of a thermal power CO3 [10] plant.

OR

- 3 (b) With the help of a layout, briefly discuss the working of a nuclear power CO3 [10] plant.

2018-19  
**B.TECH. (AUTUMN SEMESTER) EXAMINATION**  
**ELECTRONICS ENGINEERING**  
**PRINCIPLES OF ELECTRONICS ENGINEERING**  
**ELA-1110**

Maximum Marks: 60

Credits: 03

Duration: Two Hours

*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

Q.No.	Question	M.M.
1(a)	What is zener diode? Explain its working with the help of its V-I characteristics.	[07]
1(b)	Draw the circuit diagram of a full wave rectifier using two diode and centertapped transformer and explain its operation with the help of necessary wave form.	[08]
	<b>OR</b>	
1(b)'	Determine the output voltage waveform for the network of figure 1.	[08]

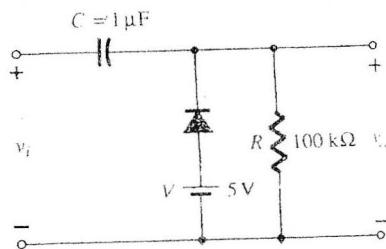
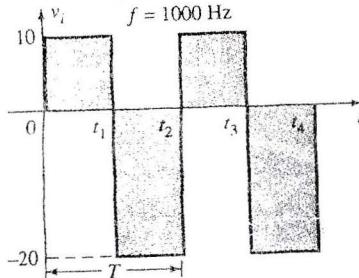


Fig. 1

- 2(a) Describe the principle of operation of a NPN bipolar junction transistor. Draw its output characteristic in common emitter configuration and describe the various regions of operation from it. [07]

**OR**

- 2(a)' Draw a neat sketch to illustrate the structure of a N-channel E-MOSFET, explain its operation and draw drain characteristics. [07]

*Contd... 2.*

- 2(b) Determine  $V_{CE}$  and  $I_C$  in the voltage-divider biased transistor circuit shown in [08]

Figure 2. Assume  $\beta_{DC} = 100$  and  $I_E \approx I_C$ .

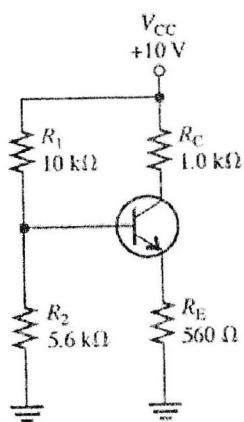


Fig. 2

- 3(a) Discuss the characteristics of an ideal operational amplifier; also explain the [07] significance of virtual ground in an operational amplifier.

- 3(b) Draw the circuit of Integrator using Op-Amp and derive an expression for its output [08] voltage.

OR

- 3(b)' Draw the circuit of non-inverting amplifiers using OP-AMP and derive an [08] expression for closed loop voltage gain.

- 4(a) What is a Decoder? Draw the truth table for 3x8-line Decoder. [07]

- 4(b) (i) Convert the decimal number 104.25 to its equivalent binary number [08]  
(ii) Add the binary numbers 101010 and 110110  
(iii) Subtract 10101 from 11011.

OR

- 4(b)' Construct the corresponding logic circuit using AND, OR gates and INVERTERS [08] for the following expressions.

- i.  $X = AB(C+D)$
- ii.  $Y = AC+BC+AB$
- iii.  $Y = M+N+PQ$

-----X-----

2018-2019

**B.ARCH./ B. TECH. AUTUMN (1 SEMESTER) EXAMINATION**

**(ELECT./ MECH./CIVIL./ CHEM./ELECTRONICS/ COMPUTER/ PETRO-CHEMICAL ENGINEERING)**

**ENGLISH**

**(EZH-1110)**

**CREDITS: 03**

**Maximum Marks: 60**

**Duration: Two Hours**

**NOTE: Attempt all questions**

**UNIT-I**

- Q1. a. The place of mathematics as a subject in the school curriculum in India ( $5 \times 2 = 10$ ) has always been valued and the need for improvement in its content and pedagogy has been emphasized by various commissions on education constituted by the Government of India. The progressive tone that is seen elsewhere in the world is also visible in this country. Time and again a need has been expressed in these documents of taking mathematics beyond mechanical computations and focus on understanding basic principles. Educationists have pointed out that "the main object of mathematics education research is to be of help in improvement of classroom learning and teaching. It is therefore natural that a large number of studies should be concerned with different aspects of this problem". They went on to suggest various dimensions of this research, including study of effective teachers, instruction based on the use of computer aided and other technology, error analysis, styles of learning among different groups of students, remedial teaching methods, study of attitudes, socio-economic and other personal factors influencing learning. More than two decades later, many of these issues, in their true sense (in the way we understand the domain and purposes of mathematics education and research in mathematics education), are yet to be researched. There have been many initiatives and interventions in the area of mathematics teaching and learning but they have not been documented and analysed; nor do we have enough illustration of the understanding, thinking and reasoning of students participating in these initiatives. What we know about their success is more anecdotal than based on systematic investigation. However, their contribution to the mathematics education scene in the country is immense. They explicated a philosophy of teaching and learning based on an understanding of the child and his/ her capacities to learn and think. These earlier attempts and deliberations made possible new ways of thinking about teaching and learning of mathematics that are seen today and have become part of the National Curriculum Framework, National Council for Educational Research and Training [NCERT] and the new textbooks developed after this.

contd... 2.

- i. What are the primary aims of mathematics education research? (2)
  - ii. How does the writer underscore the earlier initiatives in the improvement of the education of mathematics? (2)
  - iii. What negligence has been pointed out in the above paragraph? (2)
  - iv. What is suggested by "taking mathematics beyond mechanical computations"? (2)
  - v. Comment on the language of the paragraph? (2)
- b. Write a summary of the above passage. (10)

### UNIT-II

Q2. Write a critical essay on the ending of *Animal Farm*. (5)

OR

Discuss the symbolic significance of the Seven Commandments with reference to *Animal Farm*.

Q3. Critically examine the contemporary relevance of *The Time Machine*. (5)

OR

Discuss elements of realism in *The Time Machine*.

### UNIT-III

Q4. Write in detail the process of effective learning of science. (10)

OR

Write a report on the National Conference recently held at ZHCET on **The Future of Science**.

contd... 3

#### UNIT-IV

Q5. Read the following passage carefully and write précis of the same. (10)

Ours is a golden age of science, which is fine, but it is also a golden age of technology, business, management, an age of over-organisation and dehumanisation, and that is ominous and degrading. It would suffice to admit that material profits are not as desirable as many good people have been led to believe, and that there is infinitely more virtue than glory in creating beauty, justice, happiness than in creating wealth. The world today is at cross-roads of history. For the first time in history, and within the period of less than two centuries, the average span of human life has doubled itself in industrialised countries. The technological era has transformed life in many ways, its effects one can see at different levels of life. Several developing countries today enjoy a level of material prosperity and affluence never attained before; and what is more, the per capita income is rising exponentially. Besides, millions of people are still languishing in degrading poverty. The problem of poverty is no longer natural; it has to do with the economic and political organisation of a society. The increasing gap in wealth often results in social discontent and political instability in different forms. But poverty is not the only menace to mankind in general; the discovery of atomic energy and the subsequent development of lethal ammunitions have added a dehumanising dimension to war. The apprehension of mass extermination induces certain sort of unhappiness in the contemporary man of which his ancestor had no experience. Man is probably the only species in nature whose members kill each other, and in the end for nothing. When one enumerates his achievements one often tends to overlook the fact that the discovery of different forms of crime is also his unique contribution.

#### UNIT-V

Q6. Write an argumentative essay on any *one* of the following in about 300 words. (10)

- (i) Education and democracy
  - (ii) Wealth and happiness
- .....

2018-19

B.TECH. (I<sup>st</sup> SEMESTER) EXAMINATION  
 ALL BRANCHES  
 ENGINEERING MECHANICS  
 ME-111

Maximum Marks: 60

Credits: 04

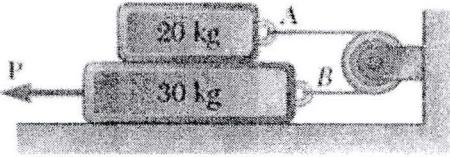
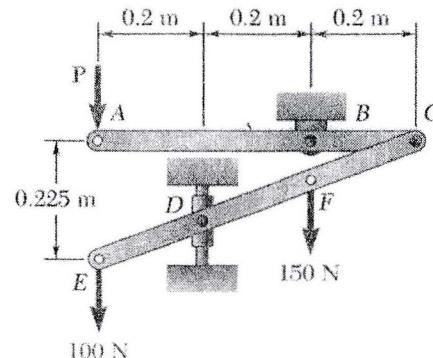
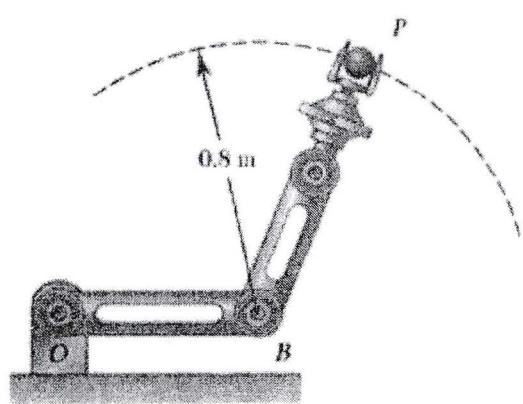
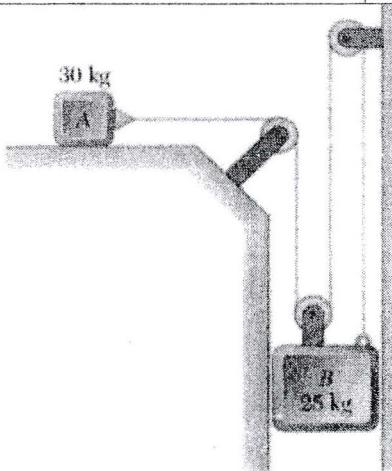
Duration: Two Hours

*Answer all the questions. Use separate Answer sheets for PART-A and PART-B.**Assume suitable data if missing.**Notations used have their usual meaning.*

Q.No.	Question	M.M.
<u>PART-A</u>		
<b>Q1</b>	Attempt any TWO parts.	
<b>1a</b>	A 12-m pole supports a horizontal cable CD and is held by a ball and socket at A and two cables BE and BF. Knowing that the tension in cable CD is 14 kN and assuming that CD is parallel to the x-axis ( $\phi = 0$ ), determine the tension in cables BE and BF and the reaction at A. (FIG1a)	[7.5]

FIG-1a

contd....2.

1b	The coefficients of friction are $\mu_s = 0.40$ and $\mu_k = 0.30$ between all surfaces of contact. Determine the smallest force $P$ required to start the 30kg block moving if cable AB (a) is attached as shown, (b) is removed. (FIG-1b)	[7.5]
1c	The two-bar linkage shown is supported by a pin and bracket at B and a collar at D that slides freely on a vertical rod. Determine the force $P$ required to maintain the equilibrium of the linkage. Use Principle of Virtual work (FIG-1c)	[7.5]
		
Q2	Attempt any TWO parts.	
2(a)	A robot arm moves so that P travels in a circle about Point B, which is not moving. Knowing that P starts from rest, and its speed increases at a constant rate of $10 \text{ mm/s}^2$ , determine (a) the magnitude of the acceleration when $t = 4 \text{ s}$ , (b) the time for the magnitude of the acceleration to be $80 \text{ mm/s}^2$ . (FIG-2a)	[7.5]
2(b)	The two blocks shown are originally at rest. Neglecting the masses of the pulleys and the effect of friction in the pulleys and between block A and the horizontal surface, determine (a) the acceleration of each block, (b) the tension in the cable. (FIG-2b)	[7.5]
		

**2(c)**

A 30-g bullet is fired with a horizontal velocity of 450 m/s through 3-kg block B and becomes embedded in carrier C which has a mass of 30 kg. After the impact, block B slides 0.3 m on C before coming to rest relative to the carrier. Knowing the coefficient of kinetic friction between B and C is 0.2, determine (a) the velocity of the bullet immediately after passing through B, (b) the final velocity of the carrier. (FIG-2c)

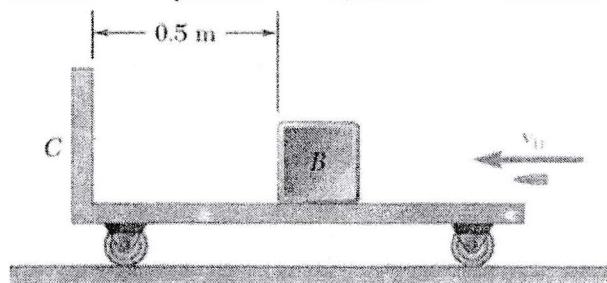


FIG-2(c)

**Q3** Attempt any TWO parts.

**3(a)**

In the position shown, bar DE has a constant angular velocity of 10 rad/s clockwise. Determine (a) the distance h for which the velocity of Point F is vertical, (b) the corresponding velocity of Point F. (FIG-3a)

[7.5]

**3(b)**

A uniform rectangular plate has a mass of 5 kg and is held in position by three ropes as shown. Knowing that  $\theta = 30^\circ$ , determine, immediately after rope CF has been cut, (a) the acceleration of the plate, (b) the tension in ropes AD and BE. (FIG-3b)

[7.5]

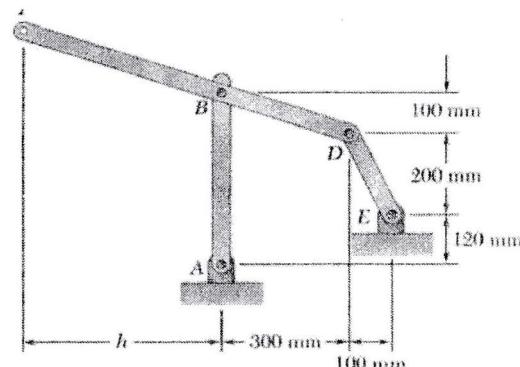


FIG-3a

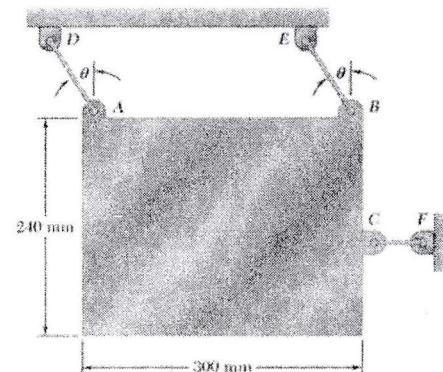
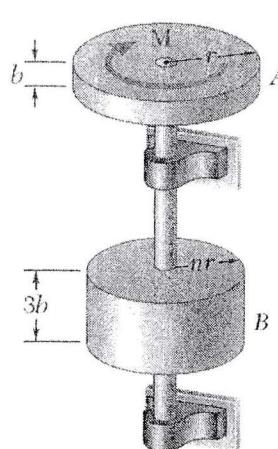


FIG-3b

contd.... 4.

3(c)	<p>Two disks of the same material are attached to a shaft as shown. Disk A is of radius <math>r</math> and has a thickness <math>b</math>, while disk B is of radius <math>nr</math> and thickness <math>3b</math>. A couple <math>M</math> of constant magnitude is applied when the system is at rest and is removed after the system has executed 2 revolutions. Determine the value of <math>n</math> which results in the largest final speed for a point on the rim of disk B. (Fig 3c)</p> 	[7.5]
<b>PART-B</b>		
Q 1a	Define the following terms: i. Body force ii. Proof stress iii. Modulus of resilience iv. Toughness	[4]
Q 1b	For a given state of stress shown in Fig. 1, determine principal stresses: $\sigma_1$ & $\sigma_2$ , maximum shear stress: $\tau_{max}$ , average stress: $\sigma_{avg}$ and angles of the planes: $\theta_p$ & $\theta_s$ on which they are acting from $x$ -axis.	[8]
Q 2a	If the beam is subjected to a bending moment of $M = 10$ kNm, determine the maximum bending stress in the beam. (Fig. 2)	[6]
OR		
Q 2a'	An aluminum specimen shown in Fig. 3 has a diameter of and a gauge length of $d_o = 25$ mm and gauge length of $L_o = 250$ mm. If a force of 165 kN elongates the gauge length 1.20 mm, determine the modulus of elasticity. Also, determine by how much the force causes the diameter of the specimen to contract. Modulus of Rigidity, $G = 26$ GPa)	
Q 2b	The horizontal shaft AD is attached to a fixed base at D and is subjected to the torques shown. A 44-mm-diameter hole has been drilled into portion CD of the shaft. Knowing that the entire shaft is made of steel for which modulus of rigidity, $G$ is 77 GPa, determine the angle of twist at end A. (Fig 4)	[6]

contd... 5.

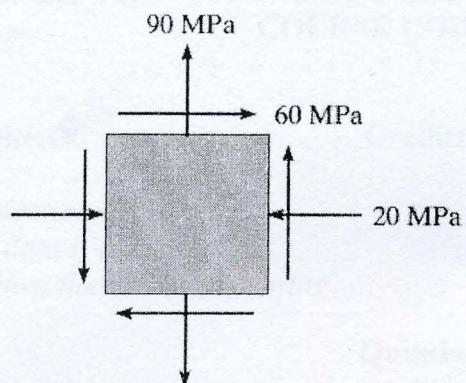


Fig. 1

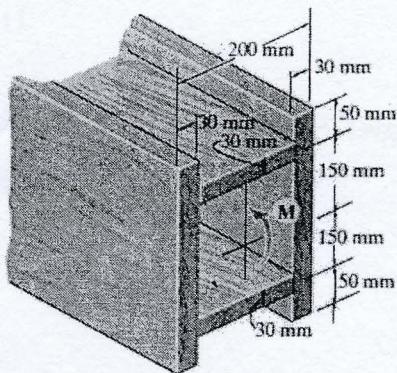


Fig. 2

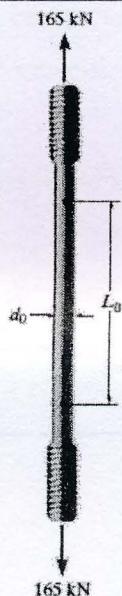


Fig. 3

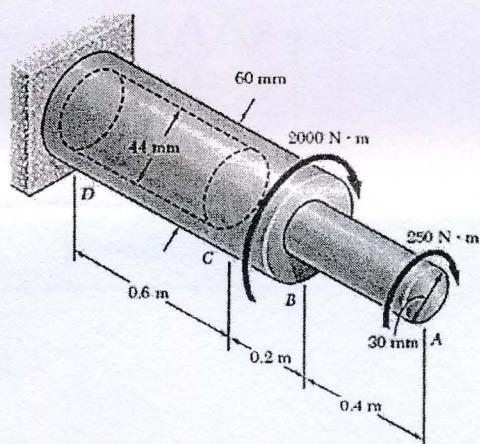


Fig. 4

2018-19

## B. TECH. (AUTUMN SEMESTER) EXAMINATION

ALL BRANCHES

MEA-1110 (ENGINEERING THERMODYNAMICS) / ME-101  
(THERMAL SCIENCES)

Maximum Marks: 60

Credits: 04

Duration: Two Hours

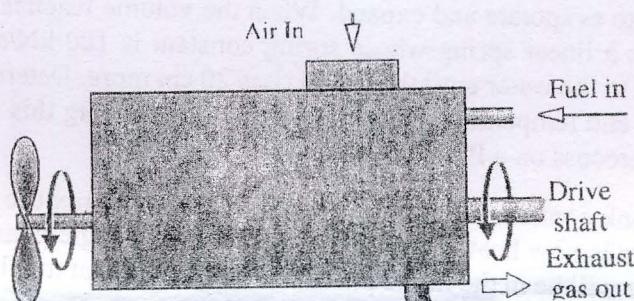
*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.**Programmable calculators (with extra memory storage) are not permitted.**Steam Tables are allowed.**Have confidence in yourself, don't depend on others.*

Q.No.

Question

COs M. M.

- 1a)** Figure below shows the combustion chamber of an engine. What type of system is it? Show a suitable system boundary to analyse this system giving justification for the same.

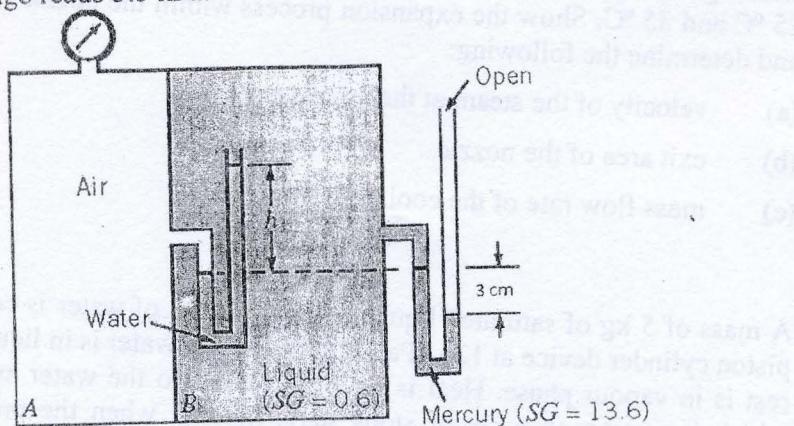


- 1b)** The relation between resistance  $R$  and temperature  $T$  for a thermistor closely follows: **CO1 [04]**

$$R = R_0 \exp \left[ \beta \left( \frac{1}{T} - \frac{1}{T_0} \right) \right]$$

where  $R_0$  is the resistance, in ohms ( $\Omega$ ), measured at temperature  $T_0$  (K) and  $\beta$  is a material constant with units of K. For a particular thermistor  $R_0 = 2.2 \Omega$  at  $T_0 = 310$  K. From a calibration test, it is found that  $R = 0.31 \Omega$  at  $T = 422$  K. Determine the value of  $\beta$  for the thermistor.

- 1c)** Compartments A and B of the tank shown in figure below are closed and filled with air and a liquid with a specific gravity equal to 0.6. Determine the manometer reading,  $h$ , if the barometric pressure is 101.35 kPa and the pressure gauge reads 3.5 kPa. **CO1 [08]**



contd.... 2.

- 2a) A 0.1 m<sup>3</sup> adiabatic rigid container is divided into two equal volumes by a thin membrane. Initially one of these chambers is filled with air at 700 kPa and 37°C while the other chamber is evacuated. Determine the internal energy change of the air when the membrane is ruptured. Also, determine the final air pressure in the container. CO2 [05]

If the insulation is then removed and heat is exchanged with surroundings so the temperature decreases by 11°C, what is the change in internal energy?

- 2b) A long, well insulated pipe line consist of two pipes connected in series, the internal diameters of which are 90 mm and 30 mm respectively. A steady flow of steam enters the 90-mm diameter pipe at a pressure of  $350 \times 10^3$  N/m<sup>2</sup>, a specific volume of 0.684 m<sup>3</sup>/kg, and an enthalpy of  $2.98 \times 10^6$  J/kg. At a point downstream in the 30-mm diameter pipe, the pressure is  $300 \times 10^3$  N/m<sup>2</sup>, the specific volume is 0.790 m<sup>3</sup>/kg and the enthalpy is  $2.968 \times 10^6$  J/kg. Determine  
(a) the velocity of the steam, at the two points in the pipe-line,  
(b) the mass flow rate of steam.

OR

- 2b') A piston cylinder device contains 50 kg of water at 150 kPa and 25°C. The cross sectional area of the piston is 0.1 m<sup>2</sup>. Heat is now transferred to the water, causing part of it to evaporate and expand. When the volume reaches 0.2 m<sup>3</sup>, the piston reaches a linear spring whose spring constant is 100 kN/m. more heat is transferred to the water until the piston rises 20 cm more. Determine (a) the final pressure and temperature and (b) the work done during this process. Also, shown the process on a P-V diagram. CO2 [10]

- 3a) Four Litre rigid tank contains 2 kg of saturated liquid vapour mixture of water at 50°C. The water is now heated slowly until it exist in a single phase. Show that whether water will be in the liquid phase or vapour phase, at the final state. CO3 [03]

OR

- 3a') What is meant by two property rule for a pure substance? Also mention the conditions in which it is applicable. CO3 [03]

- 3b) Determine the phase in a system consisting of water at the following conditions. Also show the states on a T-s plot. CO3 [04]

(a) 140°C, h = 1800 kJ/kg (b) 200 kPa, v=0.8858 m<sup>3</sup>/kg

- 3c) Steam (1Mpa, 250 °C) flowing at the rate of 1kg/s expands through a well-insulated nozzle to 10 kPa. Neglecting the velocity of the steam at the inlet of the nozzle. The steam exiting the nozzle is discharged to a condenser wherefrom it exits as saturated water. The condenser is a counter-flow heat exchanger cooled by cooling water whose inlet and exit temperatures are 25 °C and 35 °C. Show the expansion process within the nozzle on a T-s plot and determine the following:

- (a) velocity of the steam at the nozzle exit  
(b) exit area of the nozzle  
(c) mass flow rate of the cooling water

OR

- 3c') A mass of 5 kg of saturated liquid vapour mixture of water is contained in a piston cylinder device at 125 kPa. Initially 2 kg of water is in liquid phase and rest is in vapour phase. Heat is now transferred to the water and the piston which is resting on a set of stops starts moving when the pressure inside reaches 300kPa. Heat transfer continues until the total volume increase by 20%. Determine 1) Initial and Final temperature 2) Mass of liquid water when the piston starts moving 3) work done during whole process. CO3 [08]

Contd... 3

4a) Explain the relevance of second law of thermodynamics based on limitations of first law. CO4 [04]

4b) Use Clausius Inequality to show that Entropy is a property. CO4 [03]

OR

4b') Draw p-v & T-s diagrams showing processes for the Diesel cycle. CO4 [03]

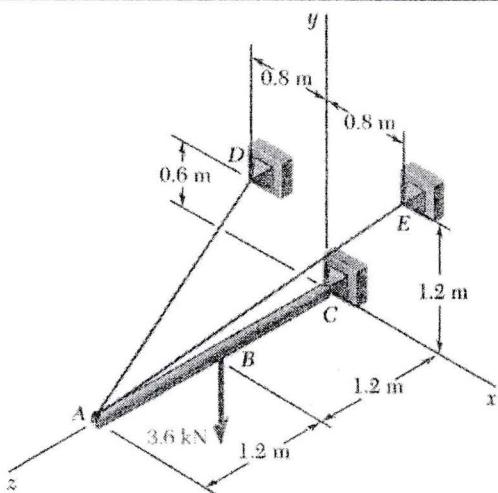
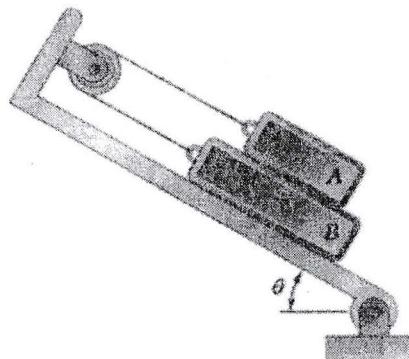
4c) A reversible engine works between three thermal reservoirs, A, B and C. The engine absorbs an equal amount of heat from the thermal reservoirs A and B kept at temperatures  $T_A$  and  $T_B$  respectively, and rejects heat to the thermal reservoir C kept at temperature  $T_C$ . The efficiency of the engine is  $\alpha$  times the efficiency of the reversible engine, which works between the two reservoirs A and C. prove that

$$\frac{T_A}{T_B} = (2\alpha - 1) + 2(1 - \alpha) \frac{T_A}{T_C}$$

2018-19

**B.TECH. (I<sup>ST</sup> SEMESTER) EXAMINATION  
ALL BRANCHES  
ENGINEERING MECHANICS  
MEA-1120**

**Maximum Marks: 60****Credits: 04****Duration: Two Hours***Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.**Course outcome (CO) are indicated against each question.*

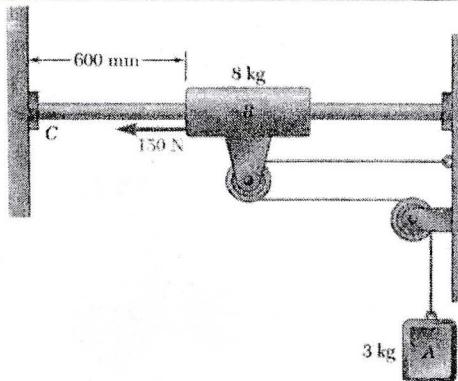
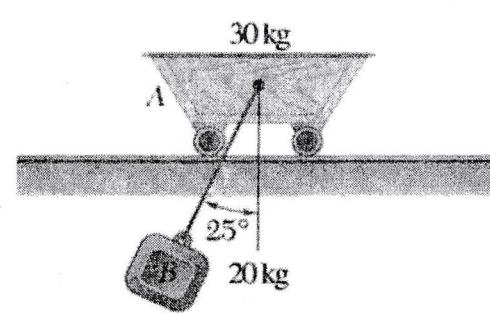
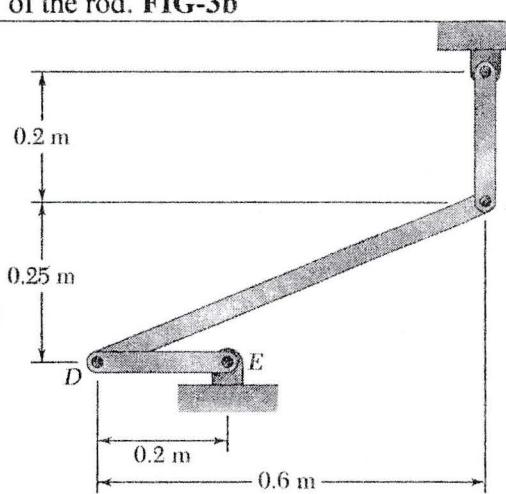
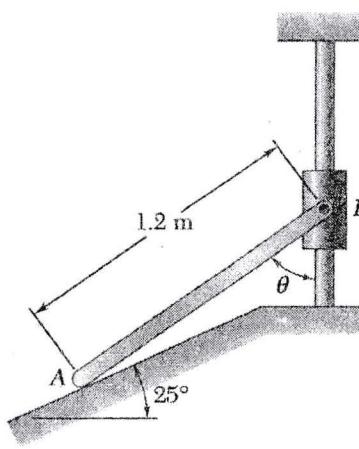
Q.No.	Question	CO	M.M.
1a	A 2.4m boom is held by a ball-and-socket joint at C and by two cables AD and AE. Determine the tension in each cable and the reaction at C. (FIG1a) <b>OR</b>	CO1	[7]
1a'	The 20N block A and the 30N block B are supported by an incline that is held in the position shown. Knowing that the coefficient of static friction is 0.15 between all surfaces of contact, determine the value of $\theta$ for which motion is impending. (FIG-1a')	CO1	[7]
	 		

**FIG-1a****FIG-1a'**

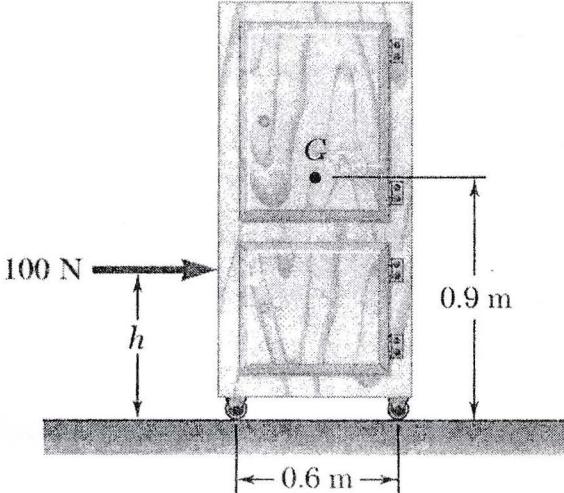
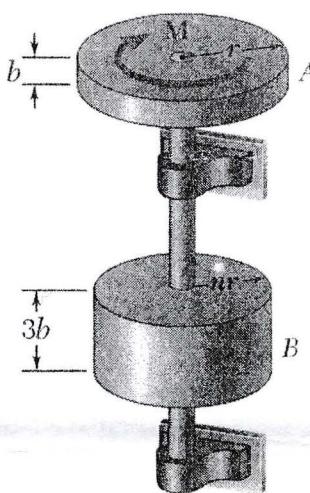
contd....2.

<b>1b</b>	Determine the horizontal force P that must be applied at A to maintain the equilibrium of the linkage. (FIG-1b)	<b>CO1</b>	[8]
	FIG-1b		
<b>2(a)</b>	At a given instant in an airplane race, airplane A is flying horizontally in a straight line, and its speed is being increased at the rate of Airplane B is flying at the same altitude as airplane A and, as it rounds a pylon, is following a circular path of 300m radius. Knowing that at the given instant the speed of B is being decreased at the rate of $3\text{ms}^{-2}$ determine, for the positions shown, (a) the velocity of B relative to A, (b) the acceleration of B relative to A. (FIG-2a)	<b>CO2</b>	[7.5]
<b>2(b)</b>	The two blocks shown are originally at rest. Neglecting the masses of the pulleys and the effect of friction in the pulleys and between block A and the horizontal surface, determine (a) the acceleration of each block, (b) the tension in the cable. (FIG-2b)	<b>CO2</b>	[7.5]
	FIG-2a		
	FIG-2b		

contd...3.

OR			
2'(a)	The system shown is at rest when a constant 150N force is applied to collar B. (a) If the force acts through the entire motion, determine the speed of collar B as it strikes the support at C. (b) After what distance $d$ should the 150N force be removed if the collar is to reach support C with zero velocity? <b>FIG-2'(a)</b>	CO2	[7.5]
2'(b)	A 20kg block B is suspended from a 2m cord attached to a 30kg cart A, which may roll freely on a frictionless, horizontal track. If the system is released from rest in the position shown, determine the velocities of A and B as B passes directly under A. <b>FIG-2'(b)</b>	CO2	[7.5]
			
	<b>FIG-2'(a)</b>	<b>FIG-2'(b)</b>	
Q3	Attempt any TWO parts.		
3(a)	Knowing that at the instant shown the angular velocity of rod AB is 15 rad/s clockwise, determine (a) the angular velocity of rod BD, (b) the velocity of the midpoint of rod BD. <b>FIG-3a</b>	CO3	[7.5]
3(b)	Collar B moves upward with a constant velocity of 1.5 m/s. At the instant when $\theta = 50^\circ$ , determine (a) the angular velocity of rod AB, (b) the velocity of end A of the rod. <b>FIG-3b</b>	CO3	[7.5]
			
	<b>FIG-3a</b>	<b>FIG-3b</b>	

Contd... 4.

3(c)	A 20kg cabinet is mounted on casters that allow it to move freely on the rough floor ( $\mu_k = 0.25$ ). If a 100N force is applied as shown, determine (a) the acceleration of the cabinet, (b) the range of values of $h$ for which the cabinet will not tip. <b>FIG-3c</b>	CO4	[7.5]
4	Two disks of the same material are attached to a shaft as shown. Disk A is of radius $r$ and has a thickness $b$ , while disk B is of radius $nr$ and thickness $3b$ . A couple $M$ of constant magnitude is applied when the system is at rest and is removed after the system has executed 2 revolutions. Determine the value of $n$ which results in the largest final speed for a point on the rim of disk B. <b>FIG-4</b>	CO4	[15]
 <p><b>FIG-3c</b></p>  <p><b>FIG-4</b></p>			