B.Tech. Third Semester (Civil Engineering / Electronics Engineering / Electronics Telecommunication Engineering / Electronics Communication Engineering / Mechanical Engineering / Aeronautical Engineering) (C.B.C.S.) Summer 2023

Applied Mathematics-III

P. Pages : 3 **MSP/KS/23/2507/2513/2525/2553**

Time : Three Hours Max. Marks : 70

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Notes :
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2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.

1. a) Find Laplace transform of $\int_0^t e^t \frac{\sin t}{t} dt$ **5**

b) Find $L^{-1}\left\{\log\frac{(s+a)}{(s+b)}\right\}$ **5**

c) Express the following functions in terms of unit step function and find their Laplace transforms. **4**

$$f(t)=\begin{cases}\cos t, & 0<t<\pi\\ \sin t, & t>\pi\end{cases}$$

OR

2. a) Find $L^{-1}\left\{\frac{1}{s\left(s^2+9\right)}\right\}$ by using convolution theorem. **5**

b) Find Laplace transform of f(t) **4**

$$f(t)=\begin{cases}\sin pt, & 0<t<\pi/p\\ 0, & \pi/p<t<2\pi/p\end{cases} \text{ and } f(t)=f(t+2\pi/p)$$

c) Solve $\frac{d^2y}{dt^2}+y=1,\ y(0)=1,\ y\left(\frac{\pi}{2}\right)=0$ **5**

By using Laplace Transform method

3. a) Sketch the function **7**

$$f(x)=\begin{cases}0, & -2<x<-1\\ 1+x, & -1<x<0\\ 1-x, & 0<x<1\\ 0, & 1<x<2\end{cases}$$

and hence find Fourier series for f(x)

b) Find the Fourier sine and cosine transform of e^{-ax} **7**

OR

4. a) Obtain half range cosine series for $f(x)=2x-1$ in interval 0<x<1. Hence show that **7**

$$\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+......$$

b) Using Fourier integral show that **7**

$$\int_0^{\infty}\frac{1-\cos\pi\lambda}{\lambda}\sin\lambda x\,d\lambda=\begin{cases}\frac{\pi}{2}, & 0<x<\pi\\ 0, & x>\pi\end{cases}$$

5. a) If $u+v=e^x(\cos y+\sin y)$, find analytic function $f(z)=u-iv$. **7**

b) Evaluate $\oint_C \frac{4-3z}{z(z-1)(z-2)}dz$, where C is a circle |z|=3/2. **7**

OR

6. a) Find the Laurent's series expansion of the function $f(z)=\frac{1}{(z-1)(z-2)}$ in the region **7**

i) $1<|z|<2$ ii) $0<|z-1|<1$

iii) $|z|>2$

b) If f(z) is analytic function with constant modulus, show that f(z) is constant. **7**

7. a) Solve, $(y+z)p-(x+z)q=x-y$ **4**

b) Solve, $\left(2D^2-5DD'+2D'^2\right)z=5\sin(2x+y)$ **5**

c) Solve the equation $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u$, given that u (x,0) = $6e^{-3x}$ by method of separation of variables. **5**

OR

8. a) Solve, $z(p-q)=z^2+(x+y)^2$ **4**

b) Solve, $\frac{\partial^2 z}{\partial x^2}-4\frac{\partial^2 z}{\partial x\,\partial y}+3\frac{\partial^2 z}{\partial y^2}=\sqrt{x+3y}$ **5**

c) Solve using Laplace transform method. **5**

$\frac{\partial u}{\partial t}+x\frac{\partial u}{\partial x}=x,\ x>0, t>0\ u(x,0)=0,\ u(0,t)=0$

9. a) Find whether the following set of vectors are linearly dependent or otherwise, if linearly dependent find the relation between them. **4**

$x_1=[1\,1\,1\,3],\ x_2=[1\ 2\ 3\ 4]\ x_3=[2\ 3\ 4\ 7]$

b) Reduce the matrix $A=\begin{bmatrix}0 & 1\\ 12 & -4\end{bmatrix}$ to diagonal form. **5**

c) Using Sylvester's theorem prove that $\sin^2 A+\cos^2 A=I,$ where $A=\begin{bmatrix}1 & 2\\ -1 & 4\end{bmatrix}$ **5**

OR

10. a) Find the singular decomposition value of matrix $A=\begin{bmatrix}1 & 0 & 1 & 0\\ 0 & 1 & 0 & 1\end{bmatrix}$ **8**

b) Find the largest eigen value and the corresponding eigen vector for the matrix. **6**

$A=\begin{bmatrix}3 & 2 & 4\\ 2 & 0 & 2\\ 4 & 2 & 3\end{bmatrix}$

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B.Tech. Third Semester (Civil Engineering) (C.B.C.S.) Summer 2023

Fluid Mechanics

P. Pages : 2 **MSP/KS/23/2508**

Time : Three Hours Max. Marks : 70

Notes :
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3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Due credit will be given to neatness and adequate dimensions.
8. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.
10. Use of non programmable calculator is permitted.

1. a) What is capillarity? Derive expression for height of capillary rise. **7**

b) The space between two parallel plates 5mm apart is filled with crude oil. A force of 2N is required to drag the upper plate at a constant velocity of 0.8 m/s. The lower plate is stationary. Determine. **7**

i) The viscosity and

ii) The kinetic viscosity of the oil in stokes if the specific gravity of oil is 0.9.

OR

2. a) State and prove “pascal’s law”. **7**

b) An inverted differential manometer containing an oil of specific gravity 0.90 is connected to find the difference of pressure at two points of a pipe containing water. If the manometer reading is 500mm find the difference of pressure. **7**

3. a) Derive expressions for total pressure and centre of pressure for a vertically immersed surface. **7**

b) A vertical square plate of size $1m \times 1m$ is immersed in water such that it’s side is parallel to water surface and lies 0.5m below it. Calculate the magnitude of total pressure and centre of pressure. **7**

OR

4. a) Discuss metacenter and metacentric height of a floating body. State the position of metacenter, centre of gravity. **7**

b) Define and explain- **7**

i) Metacentre

ii) Buoyancy

5. a) Differentiate between the Eulerian and Lagrangian methods of representing fluid flow. **7**

b) A two dimensional flow is described by the velocity components **7**
$u = 5x^3$ and $v = -15x^2 y$
Determine the stream function, velocity and acceleration at point
P (x-1m and y-2m).

OR

6. a) Write the assumptions made while deriving Bernoulli's equation. Also state and prove Bernoulli's equation. **7**

b) A pipe 350m long has a slope 1:100 and tapers from 1m dia at the higher end to 0.5m at the lower end. Quantity of water flowing is 90 lit/sec If the pressure at higher end is $70\,\mathrm{kN}/\mathrm{m}^2$. Find the pressure at the lower end. **7**

7. a) An orifice of diameter 40mm is provided in a vertical cylindrical tank of radius 550mm & length 2000mm. Find the discharge through the orifice. Take cd=0.64. **7**

b) A venturimeter with 150mm inlet diameter of 100mm throat is used for measuring flow of oil (S=0.9) Differential gauge shows a reading of 30cm. Assuming cd of 0.98. Calculate the discharge flowing through the venturimeter. **7**

OR

8. a) Coefficient of discharge of venturimeter is always greater than orificemeter why. **7**

b) Determine the discharge through a rectangular notch of length 2.1m with the head over the notch as 0.5m. Determine the discharge through the notch considering velocity of approach cd=0.64. **7**

9. a) Define and give significance of Reynolds number and Froude number. Explain both. **7**

b) Differentiate between laminar and turbulent flow. **7**

OR

10. a) What are the various methods of dimensional analysis to obtain a functional relationship between various parameters influencing a physical phenomenon? Explain any one. **7**

b) What size of pipe should be installed to carry $5.5 \times 10^{-3}\,\mathrm{m}^3/\mathrm{s}$ for medium ON (Kinematic viscosity $6 \times 10^{-6}\,\mathrm{m}^2$) Under laminar flow conditions? **7**

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B.Tech. Third Semester (Civil Engineering) (C.B.C.S.) Summer 2023

Solid Mechanics

P. Pages : 2 **MSP/KS/23/2509**

Time : Three Hours Max. Marks : 70

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Assume suitable data whenever necessary.
8. Illustrate your answers whenever necessary with the help of neat sketches.
9. Use of non programmable calculator is permitted.

1. a) Derive the relation between the modulus constant E, K & G. **7**

b) Draw Stress-Stain curve for mild steel under tension & explain salient points. **7**

OR

2. A composite bar made up of aluminium & steel is made between two supports as shown in Fig. 01. Calculate the stresses in the two bar when temperature is raised to 60ºC. The cross-section of bar of steel is 200 mm^2 and that of aluminium bar is 250 mm^2. **14**

$E_s = 2\times10^5\ N/mm^2,\quad E_{a1} = 0.75\times10^5\ W/mm^2$

$\alpha_s = 12\times10^{-6}/^\circ C,\quad \alpha_{a1} = 24\times10^{-6}/^\circ C$

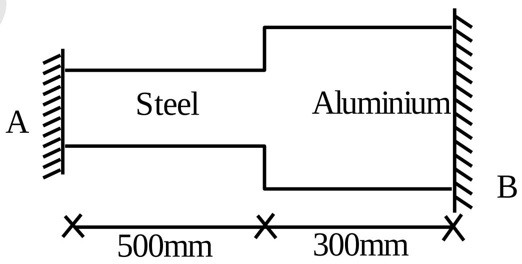
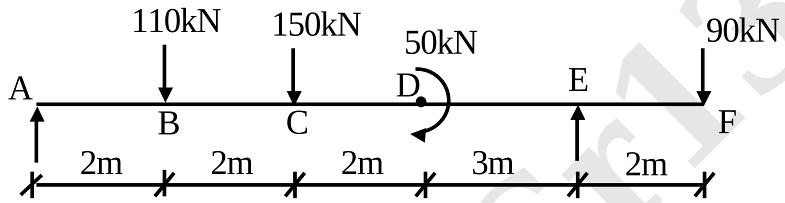


Fig. 01

3. a) Write properties of shear force Diagram and Bending Moment Diagram. **7**

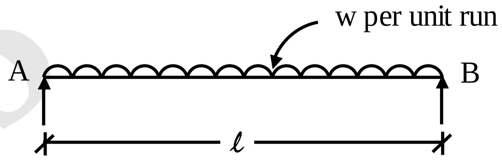
b) Draw SFD and BMD for the beam as shown in Fig. 2. Also find point of Contraflexure. **7**



OR

4. a) Derive relationship between load, shear force and Bending Moment. **7**

b) Draw SFD and BMD for a simply supported beam carrying a uniformly distributed load (udl) of w per unit run over whole span. **7**



5. Derive the Bending formula and give the assumption in theory of Simple Bending. **14**

OR

6. A simply supported beam carries a UDL of 35kN/m over entire span of 20m. The cross section of beam is 'T' section, having dimensions as shown in Fig. 03. Calculate Maximum Shear Stress for the section of beam. **14**

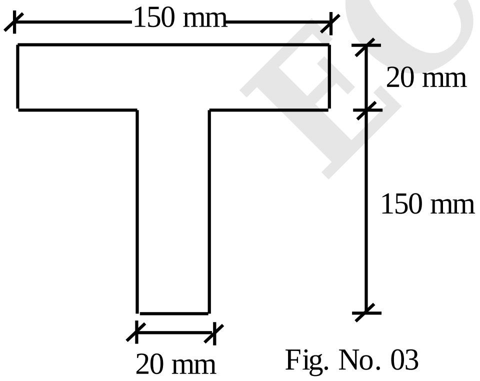
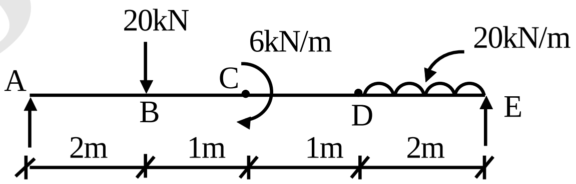


Fig. No. 03

7. Calculate the deflection under each point load for the beam as shown in Figure. 04 in terms of EI. **14**



OR

8. a) Derive differential equation of flexural beam. **7**

b) Find the deflection of Simply supported beam carrying a point load at centre. **7**

9. Derive the equation for Torsion and state assumptions in pure Torsion. **14**

OR

10. A solid circular short is to transmit 300kw at 100 r.p.m. If shaft shearing stress is limited to $80\,N/mm^2$, find the diameter of the shaft. What percentage saving in weight would be obtained if this shaft is replace by hollow one whose internal diameter is equal to 0.6 of external diameter. The length, material & the maximum shear stress being the same. **14**

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B.Tech. Third Semester (Civil Engineering) (C.B.C.S.) Summer 2023

Geotechnical Engineering

P. Pages : 2 **MSP/KS/23/2510**

Time : Three Hours Max. Marks : 70

Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
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6. Solve Question 9 OR Questions No. 10.
7. Due credit will be given to neatness and adequate dimensions.
8. Assume suitable data whenever necessary.
9. Diagrams and chemical equations should be given whenever necessary.

1. a) Write a short note on formation of soil giving names of soil on basis of mode of deposition. **6**

b) A natural deposit a bulk unit weight of 18.44 kN/m3 and water content of 5%. Calculate the amount of water required to be added to 1 cubic meter of soil to raise the water content to 15% Assume the void ratio to remain constant. What will then the degree of saturation? Assume G = 2.67. **8**

OR

2. a) Derive the relation $\gamma_d = \frac{G \cdot \gamma_w}{1+e}$ **6**

b) A soil in it's natural state has, when fully saturated, a water content of 32.5%. Determine the void ratio, dry and total unit weights. Calculate the total weight of water required to saturate soil mass of volume $10m^3$. Assume, G = 2.69. **8**

3. a) Discuss various factors affecting permeability of soil. **6**

b) The following data was recorded in a constant head permeability test: **8**
i) Diameter of sample = 75mm
ii) Head loss in a length of 180mm = 247mm
iii) Quantity of water collected in 60 sec = 626ml
iv) Void ratio = 0.785

Calculate coefficient of permeability of soil. Also determine discharge and seepage velocities.

OR

4. Write a short note **any three.** **14**
i) Application of flownet
ii) Quick sand condition
iii) Darcy's law & it's validity.
iv) Soil structure
v) Remedial measure to reduce seepage pressure in hydraulic structures.

5. a) State the equation for final consolidation settlement & explain the terms in this equation. **6**

b) In a laboratory consolidation test a 25mm thick sample takes 60 minutes to reach 50% consolidation. How much time will be a 4.5m thick layer of clay in the field required to attain- **8**
i) 50% ii) 90% consolidation if it can drain both at top & bottom.

OR

6. a) Using a Mohr's diagram drive a relationship between major & minor principal stress in a terms of shear parameters. **6**

b) Following are the results of a compaction test: **8**

Wt. of mould + wet soil (grams)	2925	3195	3150	3125	3070
Water Content (%)	11.0	13.0	15.3	16.2	18.4

Volume of the mould = 1000 c.c.
Wt. of mould = 1000 grms
Sp. Gravity of soil solids = 2.7
Find:
i) OMC and . max yd ii) Plot zero air void line
iii) Degree of saturation at γ_d max.

7. a) Explain various modes of shear failure in soil with suitable sketch. **6**

b) Determine depth at which a circular footing of 2m diameter to be laid, if it has to carry a safe load of 1600kN. The soil is having following properties. Take **8**
$C = 10\,kN/m^2$, $\phi = 30°$, $\gamma = 18\,kN/m^3$, Take $Nc = 37.2,\ Nq = 22.5,\ Nv = 19.7$.
Assume FOS=2.

OR

8. a) Explain the procedure of plate load test with assumption and limitations. **6**

b) A group of 9 piles arranged in a square pattern with diameter and length of each pile as 0.25m and 10m resp. is used as a foundation in soft clay deposit. Taking unconfined compressive strength of clay as $120\,kN/m^2$ and pile spacing 1m center to center. Find the load capacity of the pile group. **8**
Take $\alpha = 0.75$ and $Nc = 9,\ FOS = 2.5$.

9. a) Describe various salient features of the plate tectonics and various types of plate mergs along with suitable sketches. **7**

b) Describe the various physiographical and tectonic divisions of India. **7**

OR

10. What is an earthquake? Describe various causes of an earthquake. Add a note on seismic zones of India. **14**

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B.Tech. Third Semester (Civil Engineering) (C.B.C.S.)

Building Construction and Elementary Building Drawing

P. Pages : 2 **MSP/KS/23/2511**

Time : Three Hours Max. Marks : 70

Notes :
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7. Due credit will be given to neatness and adequate dimensions.
8. Illustrate your answers whenever necessary with the help of neat sketches.
9. Use of non programmable calculator is permitted.

1. a) Differentiate between load bearing and framed structure. **7**

b) What is foundation? State the essential requirement of good foundation. **7**

OR

2. a) What measures would you take while conducting foundation in black cotton soil? **7**

b) Explain plate load test for determining ultimate bearing capacity. **7**

3. a) Define 'Bond' in brick masonry work. Explain in detail English bond with neat sketch. **7**

b) Explain with a neat sketch cavity wall construction. **7**

OR

4. a) What are the appliances used for lifting heavy stones? Explain with sketches. **7**

b) What are the functions of Arches and lintels? **7**

5. a) Enumerate the causes and effects of dampness in to the structure. **7**

b) Write short note on 'Epoxy in damp proofing'. **7**

OR

6. a) Discuss the factors affecting choice of flooring materials. **7**

b) Define pitched roof. Explain various basic forms of pitched roof. **7**

7. a) Explain essential requirement of good stairs. **7**

b) Plan and design a dog-legged stair for the hall size $3.0\text{m} \times 4.5\text{m}$ with clear headroom 3.5m. Draw the sketch of plan and elevation. **7**

OR

8. a) Write short note on- **7**

i) Pivoted window

ii) Casement window

b) Explain with sketches, following types of doors. **7**

i) Collapsible Door

ii) Sliding Door

OR

9. a) Distinguish between plastering and painting. What are the different types of painting? **7**

b) What are the different types of scaffolding used? Explain any one in detail. **7**

OR

10. a) What are the good requirements of paints? **7**

b) Write short note on ‘White Washing’. **7**

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B.Tech. Third Semester (Civil Engineering) (C.B.C.S.)

Effective Technical Communication

P. Pages : 2 **MSP/KS/23/2512**

Time : Two Hours Max. Marks : 35

Notes :
1. All questions carry marks as indicated.
2. Due credit will be given to neatness and adequate dimensions.

1. a) Correct **any three** of the following sentences: **3**
1. Somebody have to clean it.
2. I am studying for four hours regularly.
3. She is always with a excuse.
4. An earth moves around the sun.
5. The teacher was red in anger when the student back answered

b) Do as directed **any three:** **3**
1. She said, “I eat pudding”.
(change the narration)
2. He must work hard to make up for the last time
(change into compound sentence)
3. He does not impress me a bit
(change the voice)
4. We should escort him.
(Add a Question tag)
5. Rihan is too poor to continue his studies.
(Use ‘so…that’)

c) Make sentence from the following idioms and phrases. Write its meaning too **any three.** **3**
1. A burning question
2. Hit the jack pot
3. Blue moon
4. Head over heels
5. Fish out of water

2. a) Do as directed **any three.** **3**
1. Write two words as examples of ‘compounding’ in English
2. Explain the workplace Jargon-Face time
3. Explain the foreign word- ‘Curriculum vitae’.
4. Make two words using the prefix ------- ‘super-’
5. Make two words using the suffix---‘-iam’

b) Do as directed **any three:** **3**
1. Choose the correct <u>synonym</u> for the word ‘Lucid’
   a) Intricate b) Noble
   c) Subtle d) Clear
2) Choose the correct <u>antonym</u> for the word ‘Timid’.
   a) Self-dependent b) Self-assertion
   c) Adjustive d) Bold
3) Find similar relationship from the options:
   CATTLE : HERD :: SPORTSMAN : ?
   a) Tournament b) Team
   c) Gang d) Medal

4) Write two words borrowed from other countries and languages.
5) Give one word for - "One who can do anything for money"

c) Write short note on different types of interview. **3**

3. a) a) Draft a job application letter in response to the following advertisement: **5**

Applications are invited for the post business analyst. Qualified Engineers having basic business knowledge in finance, marketing and management can apply to the Director of Cian Technology Pvt. Ltd. 3^{rd} Floor, Hingewadi, Pune. Mail your application along with your resume.

OR

b) Place an order of a refrigerator to Khatri sales, Ashok Vihar, Bangalore. After one month it has developed certain problems regarding its functioning. Cooling has stopped and it is making a lot of noise. Write a letter of complaint to the manager asking him for immediate repair/replacement of the same. **5**

b) Read the passage and answer the questions that follows **any four.** **4**

The inclusion of fundamental rights was demanded by Mrs. Annie Beasant in the commonwealth of India Bill. All the Fundamental Rights were in favor of the common citizens of India. Earlier, the number of Fundamental Rights in the constitution of India was seven, but at present, it's six. They are protected by the Supreme Court. The reasons for fundamental rights being 7 to 6 was the 44^{th} amendment, under which the right to the property was removed from part 3. All the fundamental rights were placed in part 3 of the constitution. Articles 12 to 15 tell about
Fundamental rights.

Questions:
1. Who demanded fundamental rights?
2. How many fundamental rights are there at present time?
3. In which part of the constitution the fundamental rights were placed?
4. What was the reason for fundamental rights being 7 to 6?
5. Who protects the fundamental rights?

4. a) As a factory manager, prepare a report about an accident that occurred in your section and provide causes and recommendations. Submit the report to the General Manager, MOIL. Ltd. Nagpur. **4**

OR

Prepare a user manual of a 'mobile' under the following headings: **4**

a) Cover page	b) Diagram
c) Functions	d) Operation
e) Precautions	f) Guarantee

b) Draft the format of a Research paper. **4**

OR

Explain in detail the components of a Technical Proposal. **4**

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