

# CBCS SCHEME

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17MAT31

## Third Semester B.E. Degree Examination, Jan./Feb. 2021 Engineering Mathematics – III

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Obtain the Fourier series of  $f(x) = x(2\pi - x)$  in  $0 \leq x \leq 2\pi$ . (08 Marks)
- b. Obtain the Fourier series for the function  $f(x) = \begin{cases} 1 + 4\frac{x}{3} & \text{in } -\frac{3}{2} < x \leq 0 \\ 1 - 4\frac{x}{3} & \text{in } 0 \leq x < \frac{3}{2} \end{cases}$  (06 Marks)
- c. Expand  $f(x) = 2x - 1$  as a Cosine half range Fourier series in  $0 < x < 1$ . (06 Marks)

### OR

- 2 a. Obtain the constant term and the coefficients of the first Cosine and Sine terms in the Fourier expansion of 'y' from the table

x	0	1	2	3	4	5
y	9	18	24	28	26	20

- b. Obtain the Fourier series of  $f(x) = |x|$  in  $-\pi \leq x \leq \pi$ . (06 Marks)
- c. Show that the sine half range series for the function  $f(x) = lx - x^2$  in  $0 < x < l$  is  $\frac{8l^2}{\pi^3} \sum_0^{\infty} \frac{1}{(2n+1)^3} \sin\left(\frac{2n+1}{l}\pi x\right)$ . (06 Marks)

### Module-2

- 3 a. If  $f(x) = \begin{cases} 1 & \text{for } |x| \leq a \\ 0 & \text{for } |x| > a \end{cases}$ , find the infinite Fourier transform of  $f(x)$  and hence evaluate  $\int_0^{\infty} \frac{\sin x}{x} dx$ . (08 Marks)
- b. Find the Fourier Cosine transform of  $e^{-x}$ . (06 Marks)
- c. Solve by using Z-transforms:  $y_{n+2} - 4y_n = 0$ , given  $y_0 = 0$  and  $y_1 = 2$ . (06 Marks)

### OR

- 4 a. Find the Fourier Sine transform of  $\frac{e^{-ax}}{x}$ ,  $a > 0$ . (08 Marks)
- b. Find the Z-transform of  $\sin(3n + 5)$ . (06 Marks)
- c. Find the inverse Z-transform of  $\frac{2z^2 + 3z}{(z+2)(z-4)}$ . (06 Marks)

**Module-3**

- 5 a. Find the coefficient of correlation for the data

x	1	3	4	2	5	8	9	10	13	15
y	8	6	10	8	12	16	16	10	32	32

(08 Marks)

- b. Fit a straight line to the following data

Year	1961	1971	1981	1991	2001
Production ( in tons)	8	10	12	10	16

(06 Marks)

- c. Compute the real root of
- $x \log_{10} x - 1.2 = 0$
- by Regula - Falsi method. Carry out three iterations in (2, 3). (06 Marks)

**OR**

- 6 a. Obtain the lines of Regression for the following values of x and y

x	1	2	3	4	5
y	2	5	3	8	7

(08 Marks)

- b. Fit an exponential curve of the form
- $y = ae^{bx}$
- for the following data

No. of petals	5	6	7	8	9	10
No. of flowers	133	55	23	7	2	2

(06 Marks)

- c. Find a real root of
- $x \sin x + \cos x = 0$
- near
- $x = \pi$
- . Correct to four decimal places, using Newton - Raphson method. (06 Marks)

**Module-4**

- 7 a. Given
- $\sin 45^\circ = 0.7071$
- ,
- $\sin 50^\circ = 0.7660$
- ,
- $\sin 55^\circ = 0.8192$
- ,
- $\sin 60^\circ = 0.8660$
- , find
- $\sin 57^\circ$
- using an appropriate interpolation formula. (08 Marks)

- b. Use Newton's divided difference formula to find
- $f(4)$
- given the data

x	0	2	3	6
f(x)	-4	2	14	158

(06 Marks)

- c. Using Simpsons
- $1/3^{\text{rd}}$
- rule, evaluate
- $\int_0^{\pi/2} \sqrt{\cos \theta} d\theta$
- by dividing
- $[0, \pi/2]$
- in to 6 equal parts. (06 Marks)

**OR**

- 8 a. From the following table find the number of students who have obtained less than 45 marks

Marks	30-40	40-50	50-60	60-70	70-80
No. of Students	31	42	51	35	31

(08 Marks)

- b. Using Lagrange's interpolation formula fit a polynomial of the form
- $x = f(y)$

x	2	10	17
y	1	3	4

(06 Marks)

- c. Evaluate
- $\int_0^1 \frac{x}{1+x^2} dx$
- by Weddle's rule taking seven ordinates. (06 Marks)

**Module-5**

- 9 a. Verify Green's theorem in a plane for  $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ , where 'C' is the boundary of the region enclosed by  $y = \sqrt{x}$  and  $y = x^2$ . (08 Marks)
- b. Verify Stoke's theorem for  $\vec{F} = (x^2 + y^2)\mathbf{i} - 2xy\mathbf{j}$  taken round the rectangle bounded by the lines  $x = \pm a$ ,  $y = 0$  and  $y = b$ . (06 Marks)
- c. Derive Euler's equation  $\frac{\partial t}{\partial y} - \frac{d}{dx} \left[ \frac{\partial t}{\partial y'} \right] = 0$ . (06 Marks)

OR

- 10 a. Use Gauss divergence theorem to evaluate  $\iiint_S \vec{F} \cdot \hat{n} \, ds$  over the entire surface of the region above xy plane bounded by the cone  $z^2 = x^2 + y^2$  the plane  $z = 4$  where  $\vec{F} = 4xz\mathbf{i} + xyz^2\mathbf{j} + 3z\mathbf{k}$ . (08 Marks)
- b. Prove that geodesics of a plane are straight lines. (06 Marks)
- c. Find the extremal of the functional  $\int_0^{\pi/2} (y^2 - y'^2 - 2y \sin x) dx$  under the end conditions  $y(0) = y(\pi/2) = 0$ . (06 Marks)

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# CBCS SCHEME

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17ME32

## Third Semester B.E. Degree Examination, Jan./Feb. 2021 Material Science

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Define Atomic Packing Factor. Calculate APF for BCC systems. (04 Marks)  
b. Classify different types of crystal – imperfections. Explain in detail line imperfections. (06 Marks)  
c. With neat sketch, explain BCC and FCC crystal structures. (10 Marks)

OR

- 2 a. With a help of neat schematic stress – strain diagram for mild steel, explain the behavior of the material till fracture. (10 Marks)  
b. Differentiate between Slip and Twinning deformations in materials. (05 Marks)  
c. Define the various fatigue properties and loads. (05 Marks)

### Module-2

- 3 a. Draw Fe – C equilibrium diagram. Mark on it all salient temperature, composition and phases. (10 Marks)  
b. What is a Solid solution? List the Hume – Rothery's rule governing formation of substitutional solid solution. (05 Marks)  
c. Sketch and explain Eutectoid Binary Phase - diagram. (05 Marks)

OR

- 4 a. State Gibb's phase rule and explain each term. (08 Marks)  
b. With neat sketches, explain forms of nucleation. (12 Marks)

### Module-3

- 5 a. What is meant by heat treatment? With relevant sketch, explain Annealing. (05 Marks)  
b. Draw a schematic TTT diagram. (05 Marks)  
c. What is Carburizing? Explain different types of Carburizing process. (10 Marks)

OR

- 6 a. Explain composition, properties and uses of Grey Cast Iron. (10 Marks)  
b. Define Hardenability. With a neat sketch, explain Jominy hardenability. (10 Marks)

### Module-4

- 7 a. State and explain the properties of Ceramics. (10 Marks)  
b. Write a short note on : i) Glass ii) Refractories. (10 Marks)

OR

- 8 a. Differentiate between Thermoplastic and Thermosetting polymers. (05 Marks)  
b. What is Processing of polymers? Explain Injection Molding methods of processing. (10 Marks)  
c. Briefly explain Shape Memory Alloys. (05 Marks)

**Module-5**

- 9 a. What is the role of matrix and reinforcement in a composite? (05 Marks)  
b. Explain the following : (15 Marks)  
i) Pultrusion process      ii) Hand – layup process.

**OR**

- 10 a. Calculate the modulus of elasticity of unidirectional carbon - fiber reinforced composite material which contains 62% by volume of carbon fibers in iso – strain and iso – stress condition.  
 $E_{\text{Carbon fibers}} = 3.86 \times 10^4 \text{ kg f/mm}^2$  and  $E_{\text{epoxy}} = 4.28 \times 10^2 \text{ kg f/mm}^2$ . (08 Marks)  
b. Write a short note on : (12 Marks)  
i) CMC      ii) PMC      iii) MMC.

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# CBCS SCHEME

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17ME33

## Third Semester B.E. Degree Examination, Jan./Feb. 2021 Basic Thermodynamics

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Use of thermodynamic data book, steam tables are permitted.*

### Module-1

- 1 a. What is thermodynamics? Differentiate between the classical and statistical approaches to thermodynamics. (06 Marks)
- b. Classify the following into intensive and extensive properties.
- i) Enthalpy specific entropy
  - ii) Viscosity
  - iii) Quality of steam
  - iv) Refractive index
  - v) Roll strength of class. (06 Marks)
- c. A new scale N of temperature is devised in such a way that the freezing point of ice is  $100^{\circ}\text{N}$  and the boiling point of water is  $400^{\circ}\text{N}$ . What is the temperature reading on this new scale when the temperature is  $150^{\circ}\text{C}$ ? At what temperature both the Celsius and the new scale reading would be the same? (08 Marks)

OR

- 2 a. Distinguish between:
- i) Point function and path function
  - ii) Intensive and extensive property. (08 Marks)
- b. What is flow work? Is it different from displacement work? (04 Marks)
- c. To a closed system 150kJ of work is supplied. If the initial volume is  $0.6\text{m}^3$  and pressure of the system changes as  $P = 8-4V$ , where P is in bar and V is in  $\text{m}^3$ , determine the final volume and pressure of the system. (08 Marks)

### Module-2

- 3 a. State the first law of thermodynamics for a closed system undergoing change of state. Explain the property introduced by this law. (04 Marks)
- b. What are the limitations of first law of thermodynamics? (04 Marks)
- c. A stationary fluid system goes through a following cycle:
- Process 1-2 isochoric heat addition of 235kJ/kg
  - Process 2-3 adiabatic expansion to its original pressure with loss of 70kJ/kg in internal energy.
  - Process 3-1 isobaric compression to its original volume with heat rejection of 200kJ/kg
- Prepare a balance sheet of energy quantities. (12 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 4 a. Define the following:
- Thermal Energy Reservoir (TER)
  - Mechanical Energy Reservoir (MER). (04 Marks)
- b. Show that efficiency of a reversible engine is independent of the nature or amount of the working substance going through the cycle. (06 Marks)
- c. An inventor claims that his engine has the following specifications:
- Heating value of the fuel : 74500kJ/kg  
 Temperature limits : 750°C and 25°C  
 Power developed : 75kW  
 Fuel burnt : 0.07kg/min
- State whether claim is valid or not. (10 Marks)

Module-3

- 5 a. Explain the conditions for reversibility. (06 Marks)
- b. Show that heat transfer through a finite temperature difference is irreversible. (06 Marks)
- c. Determine the entropy change of 4kg of a perfect gas whose temperature varies from 127°C to 227°C during a constant volume process. The specific heat varies linearly with absolute temperature and is given by the relation  $C_v = (0.48 + 0.0096T)$ kJ/kg K. (08 Marks)

OR

- 6 a. Define entropy and show that entropy is a property of system. (06 Marks)
- b. Write the criteria of reversibility, irreversibility and impossibility to a thermodynamic cycle. (06 Marks)
- c. A Carnot engine absorbs 200J of heat from a reservoir at the temperature of the normal boiling point of water and rejects heat to a reservoir at the temperature of the triple point of water. Find the heat rejected, the work done by the engine and the thermal efficiency. (08 Marks)

Module-4

- 7 a. Define the following:
- Thermodynamic dead state
  - Energy
  - Second law efficiency. (06 Marks)
- b. Energy is always conserved, but its quality is always degraded. Explain. (04 Marks)
- c. Prove that,  $\eta_{II} = \frac{\eta_I}{\eta_{\text{Carnot}}}$  (10 Marks)

OR

- 8 a. Draw the phase equilibrium diagram on P-V coordinate for a pure substance, whose volume decreases on melting. (04 Marks)
- b. State whether the following samples of steam are wet, dry or superheated: Justify your answer.
- Temperature = 200°C, pressure = 1.2MPa
  - Pressure = 1MPa volume = 0.235m<sup>3</sup>/kg
  - Pressure = 500kPa enthalpy = 2530kJ/kg
  - Temperature = 100°C entropy = 7.35kJ/kg K (08 Marks)
- c. What is dryness fraction of steam? Explain the method of estimating quality of wet steam by a combined separating and throttling calorimeter. (08 Marks)

Module-5

- 9 a. State 'Dalton's law of partial pressure' (04 Marks)
- b. Define the following terms:
- i) Saturated air
  - ii) Wet bulb temperature
  - iii) Specific humidity
  - iv) Dew point temperature. (04 Marks)
- c. A mixture of gas has the following volumetric analysis.  $O_2 = 30\%$ ,  $CO_2 = 40\%$ ,  $N_2 = 30\%$ . Determine:
- i) The analysis on a mass base.
  - ii) The partial pressure of each component if the total pressure is 100kPa and temperature is  $32^\circ C$ .
  - iii) The molecular weight of mixture. (12 Marks)

## OR

- 10 a. What is the generalized compressibility chart? Explain. (04 Marks)
- b. Write the Vander Waal's equation of state. In what ways, it is an improvement over the ideal gas equation of state. (04 Marks)
- c. One kg-mol of oxygen undergoes a reversible non-flow isothermal compression and the volume decreases from  $0.2m^3/kg$  to  $0.08m^3/kg$  and the initial temperature is  $60^\circ C$ . If the gas obeys Vander Waal's equation find: i) the work done during the process ii) the find pressure. (12 Marks)

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# CBCS SCHEME

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17ME34

## Third Semester B.E. Degree Examination, Jan./Feb. 2021 Mechanics of Materials

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Define :
- (i) Hook's law (ii) Poisson's ratio (iii) Modulus of rigidity (iv) Modulus of elasticity (v) Bulk modulus. (05 Marks)
- b. Draw stress-strain diagram of a mild steel and name the salient points. (05 Marks)
- c. A brass bar having cross-sectional area  $300 \text{ mm}^2$  is subjected to axial forces as shown in Fig.Q1(c). Find the total elongation of the bar.  $E = 84 \text{ GPa}$ . (10 Marks)

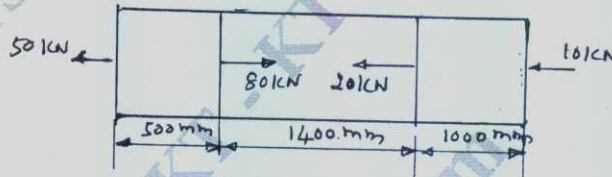


Fig.Q1(c)

OR

- 2 a. Define :
- (i) Elasticity (ii) Plasticity (iii) Stiffness (iv) Resilience (v) Toughness (05 Marks)
- b. Derive a relation between modulus of elasticity, modulus of rigidity and bulk modulus. (05 Marks)
- c. At room temperature the gap between two bars as shown in Fig.Q2(c) is  $0.25 \text{ mm}$ . What are the stresses induced in the bars, if temperature rise is  $35^\circ\text{C}$ . Given  $A_A = 1000 \text{ mm}^2$ ,  $A_B = 800 \text{ mm}^2$ ,  $E_A = 2 \times 10^5 \text{ MPa}$ ,  $E_B = 1 \times 10^5 \text{ MPa}$ ,  $\alpha_A = 12 \times 10^{-6} \text{ per } ^\circ\text{C}$ ,  $\alpha_B = 23 \times 10^{-6} \text{ per } ^\circ\text{C}$ .

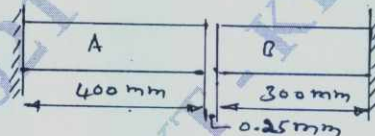


Fig.Q2(c)

(10 Marks)

### Module-2

- 3 a. Define principal plane and principal stress. (02 Marks)
- b. Derive an expression for hoop stress and longitudinal stress for thin cylinder. (06 Marks)
- c. At a point in a strained material the stress condition shown in Fig.Q3(c). Find
- (i) Normal and shear stresses on the inclined plane AB.
- (ii) Principal stress and principal planes
- (iii) Maximum shear stress. (12 Marks)

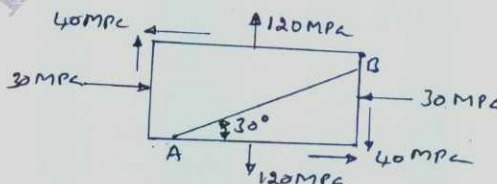


Fig.Q3(c)

1 of 2

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8=50, will be treated as malpractice.

OR

- 4 a. Derive Lamé's equation for thick cylinder. (08 Marks)  
 b. A pipe of 500 mm internal diameter and 75mm thick is filled with a fluid at a pressure of  $6 \text{ N/mm}^2$ . Find the maximum and minimum hoop stress across the cross-section of the cylinder. Also sketch the radial pressure and hoop stress distribution across the section. (12 Marks)

Module-3

- 5 a. Derive the relations between intensity of load 'W', shear force 'F' and bending moment 'M' in the beam. (06 Marks)  
 b. Draw bending moment and shear force diagram for the beam shown in Fig.Q5(b). Clearly indicate the point of contraflexure. (14 Marks)

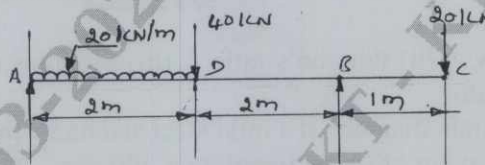


Fig.Q5(b)

OR

- 6 a. Derive the relationship between bending stress and radius of curvature. (06 Marks)  
 b. The T-section shown in Fig.Q6(b) is used as a simply supported beam over a span of 4 meters. It carries an uniformly distributed load of  $8 \text{ kN/m}$  over its entire span. Calculate the maximum tensile and compressive stresses occurring in the section. (14 Marks)

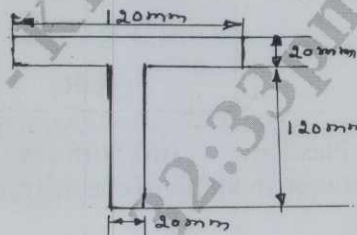


Fig.Q6(b)

Module-4

- 7 a. Derive the torsional equation. (10 Marks)  
 b. A solid shaft rotating at 1000 rpm transmits 50 kW. Maximum torque is more than 20% of mean torque. Material of the shaft had the allowable shear stress of 50 MPa and  $G = 80 \text{ GPa}$ . Angle of twist in the shaft should not exceed  $1^\circ$  per meter length. Determine the diameter of the shaft. (10 Marks)

OR

- 8 a. Derive the expression for crippling load for a column when both ends are hinged. (10 Marks)  
 b. Determine the crippling load for a T-section of dimensions  $100\text{mm} \times 100\text{mm} \times 20\text{mm}$  and length of column 12m with both ends fixed. Take  $E = 210 \text{ GPa}$ . (10 Marks)

Module-5

- 9 a. Explain : (i) Castiglino's first theorem (ii) Castiglino's second theorem (10 Marks)  
 b. A cantilever beam of uniform cross-section carries a point load at the free end. Determine strain energy and deflection at the free end, if  $F = 200 \text{ kN}$ ,  $E = 200 \text{ GPa}$ ,  $L = 3 \text{ m}$  and  $I = 10^{-4} \text{ m}^4$ . (10 Marks)

OR

- 10 a. Explain maximum normal stress theory and maximum shear stress theory. (10 Marks)  
 b. A machine member made of C40 steel having the yield stress of 328.6 MPa is loaded as follows.  $\sigma_x = 60 \text{ MPa}$ ,  $\sigma_y = -20 \text{ MPa}$  and  $\tau_{xy} = 30 \text{ MPa}$ . Determine the factor of safety by (i) Maximum normal stress theory (ii) Maximum shear stress theory. (10 Marks)

# CBCS SCHEME

USN

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17CPH39/49

**Third/Fourth Semester B.E. Degree Examination, Jan./Feb. 2021**  
**Constitution of India and Professional Ethics and Human Rights**

**(COMMON TO ALL BRANCHES)**

Time: 2 hrs.]

[Max. Marks: 30

## INSTRUCTIONS TO THE CANDIDATES

1. Answer all the thirty questions, each question carries **ONE** mark.
2. Use only **Black ball point pen** for writing / darkening the circles.
3. **For each question, after selecting your answer, darken the appropriate circle corresponding to the same question number on the OMR sheet.**
4. Darkening two circles for the same question makes the answer invalid.
5. **Damaging/overwriting, using whiteners** on the **OMR** sheets are strictly prohibited.

- 
1. When the Indian Constitution given effect  
a) 26.10.1949                      b) 26.12.1949  
c) 26.01.1950                      d) 26.01.1949
  2. Which of the following word was added in the Preamble of the Constitution by 42<sup>nd</sup> Amendment Act 1976  
a) Socialist                              b) Sovereign  
c) Federal                                d) Republic
  3. The President power to suspend death sentence temporarily is called  
a) Respite                                b) Reprieve  
c) Remission                            d) Constitution
  4. The Preamble of the Constitution has been amended so far  
a) 4 times                                b) 3 times  
c) Twice                                 d) Once
  5. Which one of the following is not one of the 3 organs of the state/union?  
a) Executive                              b) Press  
c) Judiciary                                d) Legislation
  6. Which one of the following states constitution has been removed by the Parliament?  
a) West Bengal                            b) Nagaland  
c) Sikkim                                 d) J & K

7. Which one of the landmark judgment passed by the Supreme Court in respect of Preamble of the Constitution
- a) Beru Bari  
b) Keshavananda Bharathi  
c) Menaka Gandhi  
d) Sonia Gandhi
8. Who is the Neutral person in the affairs of the party politics?
- a) C.M.  
b) Home Minister  
c) Finance Minister  
d) Speaker
9. Indian Constitution guarantees reservation of seats to SC and ST in
- a) Loksabha and Assembly only  
b) Loksabha only  
c) Loksabha and Rajyasabha  
d) Rajyasabha
10. India is referred to as \_\_\_\_\_ under the Indian Constitution
- a) Country  
b) Hindustan  
c) India  
d) Bharat
11. Who will preside over the joint session of both the houses of the parliament
- a) President  
b) Prime Minister  
c) Speaker  
d) Law Minister
12. What is the minimum age for becoming M.P. in Rajyasabha and Loksabha
- a) 18 & 25 years  
b) 25 & 18 years  
c) 35 & 25 years  
d) 30 & 25 years
13. The citizens can enforce their Fundamental Rights before SC under Article
- a) Art 31  
b) Art 32  
c) Art 33  
d) Art 34
14. Who quoted "Child of Today is Citizen of Tomorrow"?
- a) L. Tilak  
b) Jawaharlal Nehru  
c) B.R. Ambedkar  
d) Gandhiji
15. Who quoted "Freedom is my birth right"
- a) L. Tilak  
b) Jawaharlal Nehru  
c) Sardar Patel  
d) Gandhiji
16. No person shall be punished for same offence more than once
- a) Jeopardy  
b) Double Jeopardy  
c) Ex-post facto law  
d) Testimonial compulsion
17. When the Office of The President falls vacant the same must be filled up within
- a) 4 months  
b) 6 months  
c) 12 months  
d) 18 months
18. Which important Human Rights is protected under Article 21
- a) Right to Equality  
b) Right to Life and Personal Liberty  
c) Right to Freedom of Speech  
d) Right to Religion

19. The Rajya Sabha is  
a) Is a Permanent House  
c) Has a life of 5 years  
b) Has a life of 6 years  
d) Has a life of 7 years
20. The Quorum or minimum number of members required to hold the meetings of either houses of the Parliament is  
a) One-tenth  
c) One-third  
b) One-fifth  
d) One-fourth
21. Article 19 provides  
a) 6 freedoms  
c) 8 freedoms  
b) 7 freedoms  
d) 5 freedoms
22. One of the salient features of our Constitution is  
a) It is fully rigid  
c) It is partly rigid and partly flexible  
b) It is fully flexible  
d) None of these
23. Who is the present Speaker of Lok Sabha  
a) Sumithra Mahajan  
c) Om Birla  
b) K.S.Hegde  
d) Venkiah Naidu
24. The Chief Election Commission holds office for a period of  
a) 3 yrs  
c) 5 yrs  
b) 6 yrs  
d) 6 yrs or till he attains the age of 65 years
25. The procedure for amending the Constitution is detailed under  
a) Art 360  
c) Art 352  
b) Art 368  
d) Art 301
26. Writ of Mandamus can be issued on the ground of  
a) Non-performance of public duties  
c) Unlawful occupation of public offence  
b) Unlawful Detention  
d) None of these
27. Engineering Ethics is  
a) A macro ethics  
c) A preventive ethics  
b) Business Ethics  
d) A code of scientific rules based on ethics
28. The use of Intellectual Property of others without permission is referred as  
a) Cooking  
c) Plagiarism  
b) Stealing  
d) Trimming
29. Who appoints the Lieutenant General to Delhi  
a) Prime Minister  
c) President  
b) Home Minister  
d) Vice-President
30. The final interpreter to the Indian Constitution is  
a) Speaker of Lok Sabha  
c) President  
b) Parliament  
d) SC

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# CBCS SCHEME

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17MATDIP31

## Third Semester B.E. Degree Examination, Jan./Feb. 2021 Additional Mathematics - I

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1
- a. Find the modulus and amplitude of  $\frac{(1+i)^2}{3+i}$ . (06 Marks)
- b. If  $x + \frac{1}{x} = 2 \cos \alpha$ , then prove that  $x^n + \frac{1}{x^n} = 2 \cos n \alpha$ . (07 Marks)
- c. Find the fourth roots of  $1 - \sqrt{3}$  and represent them on an argand plane. (07 Marks)

OR

- 2
- a. If the vectors  $2\hat{i} + \lambda\hat{j} + \hat{k}$  and  $4\hat{i} - 2\hat{j} - 2\hat{k}$  are perpendicular to each other than find the value of  $\lambda$ . (06 Marks)
- b. Find the sine of the angle between the vectors  $\vec{a} = \hat{i} + \hat{j} + \hat{k}$  and  $\vec{b} = 2\hat{i} - 3\hat{j} + 2\hat{k}$ . (07 Marks)
- c. Find  $\lambda$  such that the vectors  $2\hat{i} - \hat{j} + \hat{k}$ ,  $\hat{i} + 2\hat{j} - 3\hat{k}$  and  $3\hat{i} + \lambda\hat{j} + 5\hat{k}$  are coplanar. (07 Marks)

### Module-2

- 3
- a. Find the  $n^{\text{th}}$  derivative of  $\cos x \cos 2x \cos 3x$ . (06 Marks)
- b. With usual notations prove that  $\tan \phi = r \frac{d\theta}{dr}$ . (07 Marks)
- c. Prove that  $\sqrt{1 + \sin 2x} = 1 + x - \frac{x^2}{2} - \frac{x^3}{3} + \frac{x^4}{24} + \dots$ . By using Maclaurin's expansion. (07 Marks)

OR

- 4
- a. If  $u = \tan^{-1} \left( \frac{x^3 + y^3}{x - y} \right)$ , prove that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \sin 2u$ . (06 Marks)
- b. If  $u = f \left( \frac{x}{y}, \frac{y}{z}, \frac{z}{x} \right)$ , prove that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z} = 0$ . (07 Marks)
- c. If  $u = e^x \cos y$ ,  $v = e^x \sin y$ , find  $J = \frac{\partial(u, v)}{\partial(x, y)}$ . (07 Marks)

### Module-3

- 5
- a. Evaluate  $\int_0^{\pi} x \cos^6 x \, dx$ . (06 Marks)
- b. Evaluate  $\int_0^1 \int_0^1 \frac{dx dy}{\sqrt{(1-x^2)(1-y^2)}}$ . (07 Marks)
- c. Evaluate  $\int_0^1 \int_0^2 \int_1^2 x^2 y z \, dx \, dy \, dz$ . (07 Marks)

OR

- 6 a. Evaluate  $\int \sin^6 x \, dx$ . (06 Marks)
- b. Evaluate  $\iint_R (x^2 + y^2) \, dx \, dy$ , where R is the triangle bounded by the lines  $y = 0$ ,  $y = x$  and  $x = 1$ . (07 Marks)
- c. Evaluate  $\int_0^1 \int_0^1 \int_0^1 e^{x+y+z} \, dx \, dy \, dz$ . (07 Marks)

**Module-4**

- 7 a. A particle moves along a curve whose position vector is given by  $\vec{r} = \left(t - \frac{t^3}{3}\right)\hat{i} + t^2\hat{j} + \left(t + \frac{t^3}{3}\right)\hat{k}$ . Find the velocity and acceleration at  $t = 3$ . (06 Marks)
- b. Find the unit normal vector to the surface  $xy + x + zx = 3$  at  $(1, 1, 1)$ . (07 Marks)
- c. Find  $\text{div } \vec{F}$  and  $\text{curl } \vec{F}$ , where  $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$ . (07 Marks)

OR

- 8 a. A particle moves so that its position vector is given by  $\vec{r} = \cos wt \hat{i} + \sin wt \hat{j}$ , where  $w$  is a constant. Show that the velocity  $\vec{V}$  is perpendicular to  $\vec{r}$ . (06 Marks)
- b. If  $\vec{F} = (x + y + 1)\hat{i} + \hat{j} - (x + y)\hat{k}$ , show that  $\vec{F} \text{ curl } \vec{F} = 0$ . (07 Marks)
- c. Show that  $\vec{f} = (\sin y + z)\hat{i} + (x \cos y - z)\hat{j} + (x - y)\hat{k}$  is irrotational. Also find  $\phi$  such that  $\vec{f} = \nabla\phi$ . (07 Marks)

**Module-5**

- 9 a. Solve  $\frac{dy}{dx} = 1 + \frac{y}{x} + \left(\frac{y}{x}\right)^2$ . (06 Marks)
- b. Solve  $\frac{dy}{dx} + y \cot x = \sin x$ . (07 Marks)
- c. Solve  $(x^2 + y)dx + (y^3 + x)dy = 0$ . (07 Marks)

OR

- 10 a. Solve  $\frac{dy}{dx} + \frac{y}{x} = y^2x$ . (06 Marks)
- b. Solve  $(y \cos x + \sin y + y) \, dx + (\sin x + x \cos y + x) \, dy = 0$ . (07 Marks)
- c. Solve  $y^2 + x^2 \frac{dy}{dx} = xy \frac{dy}{dx}$ . (07 Marks)

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