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SEMESTER END EXAMINATIONS – AUGUST 2021

Programme & Branch : B.Tech. Common to ECE, CSE, IOT, AIDS and IT

Semester : II   Date & Session ÷ 06/08/2021 FN

Course Code & Name : PHCX 09 &Semiconductor Physics and Optoelectronics

Duration : 120 minutes   Maximum Marks : 100

PART A (20 X 2 = 40 MARKS)
Answer all the Questions

1. Draw the energy band diagram of an n-type semiconductor

2. Differentiate between donor and acceptor atoms in a semiconductor.

3. Calculate the wavelength of the radiation from the $CuInSe_2$ semiconductor which has an energy bandgap of 1.02 eV.

4. How does the electrical conductivity of a semiconductor vary with temperature?

5. Give two examples each for elemental and compound semiconductors.

6. How is the Hall voltage produced by the Hall effect?

7. Sketch the band diagram for a p-n junction.

8. Define dark current.

9. Mention the types of LED.

10. Point out the advantages of heterojunction semiconductor diode laser over homojunction laser diode.

11. What is the general principle of optical modulation?

12. Write down the expression relating to the dielectric constant and refractive index.

13. Define half-wave voltage with its expression.

14. What is the Kerr effect?

15. Give two reasons for the photodetectors to have a wide depletion layer.

16. List out two advantages of the avalanche photodiode over the PIN photodiode.

17. In a 100-ns pulse, 6×10^6 photons at a wavelength of 1300 nm fall on an In GaAs photodetector. On average, 5.4×10^6 electron-hole pairs are generated. Find out the quantum efficiency.

18. Photons of energy of 1.53×10^{-19}J are incident on a photodiode which has a responsivity of 0.65 A/W. If the optical power level is 10 µW, calculate the photocurrent generated.

19. Draw the symbol of the phototransistor and mention its use.

20. What is the photovoltaic effect?

PART B (3 X 20 = 60 MARKS)
Answer any three Questions

21. What is an intrinsic semiconductor? Derive the expressions for its electron and hole density and hence deduce the expression for the intrinsic carrier concentration. **(20)**

22. (i) Explain the working of dynamic scattering LCD with a neat sketch. **(10)**

(ii) Discuss the principle and operation of a homojunction and heterojunction LED. **(10)**

23. (i) Elucidate the working of an electro-optic amplitude modulator with the necessary theory of phase shift and modulated intensity of light. **(16)**

(ii) Write short notes on the magneto-optic modulator. **(4)**

24. (i) Illustrate the PIN photodiode with suitable sketches and relevant theory. **(12)**

(ii) Arrive at the expression for the signal-to-noise ratio. **(8)**

25. (i) With the necessary diagrams, explain the principle and operation of the solar cell. Explain the terms open-circuit voltage, short-circuit current, conversion efficiency and Fill Factor(FF). **(12)**

(ii) A 5 cm^2 Ge solar cell has a dark reverse current of 2 nA. The AMI radiation incident upon it produces 4×10^{17} electron-hole pairs per second. The electron diffusion length is 5µm and the hole diffusion length is 5µm. Calculate the short-circuit current and open-circuit voltage of the cell. **(4)**

(iii) Write short notes on the charge-coupled device. **(4)**

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SEMESTER END EXAMINATIONS – AUG 2021

Programme & Branch   :   B.Tech – Common to all branches except Bio Tech

Semester   :   II   Date & Session   :   11/08/2021 & FN

Course Code & Name   :   GEC1211 & Basic Engineering Mechanics

Duration   :   150 Minutes   Maximum Marks   :   100

<ASSUME ANY MISSING DATA SUITABLY>

PART A (20 X 2 = 40 MARKS)

Answer all the Questions

1. Two forces are applied to a hook as shown in figure 1. Determine the magnitude and direction of their resultant using the parallelogram law.
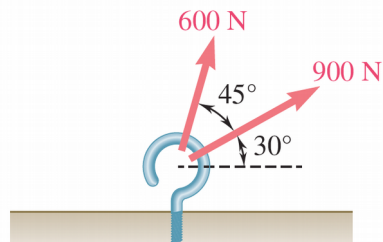

Figure 1

2. State sine law.
3. Define triangular law of forces.
4. Differentiate between coplanar forces and collinear forces.
5. The degrees of freedom for any particle is 5. True or False? List the degrees of freedom.
6. What do you mean by equilibrium of a particle?
7. State Varignon's theorem.
8. Distinguish between moment and couple.
9. List the conditions of equilibrium.
10. Determine the cosine angle with respect to y direction for the force

$$12\vec{i} + 10\vec{j} - 15\vec{k}$$.

11. Define centroid.
12. If the Moment of Inertia of a rectangular bar about x axis is greater than the moment of inertia about y axis, the bending of the bar will be in which direction?
13. Write the formula for centroid for a quadrant of a circle, whose origin is at the centre of the circle.
14. List some application where the friction needs to be reduced.
15. Define angle of repose?

16.   If the coefficient of friction is 0.3, what will be the angle of friction?
17.   How impending motion differs from static and dynamic condition?
18.   Distinguish kinetics and kinematics.
19.   If a block moves with a initial velocity of 0.5 m/s at 1.75 m/s^2 acceleration, at

what time it will reach 50 m?
20.   Define impulse.

PART B (5 X 12 = 60 MARKS)

Answer any Five Questions

21   The members of a truss are pin connected at joint O as shown in figure 2.   **(12)**
Determine the magnitude of F_1 and its angle θ for equilibrium. Set F_2 = 6 kN.
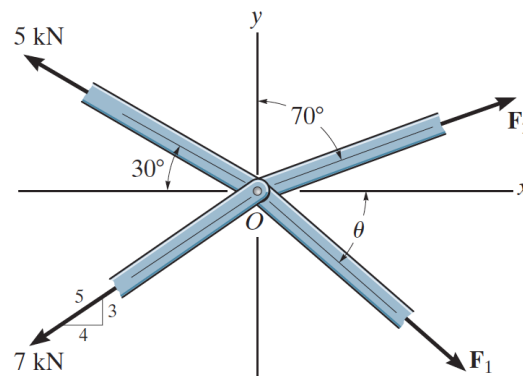

Figure 2

22   A transmission tower is held by three guy wires attached to a pin at A and   **(12)**
anchored by bolts at B, C, and D as shown in figure 3. If the tension in wire
AB is 600 N, the tension in wire AC is 750 N, determine the resultant for the
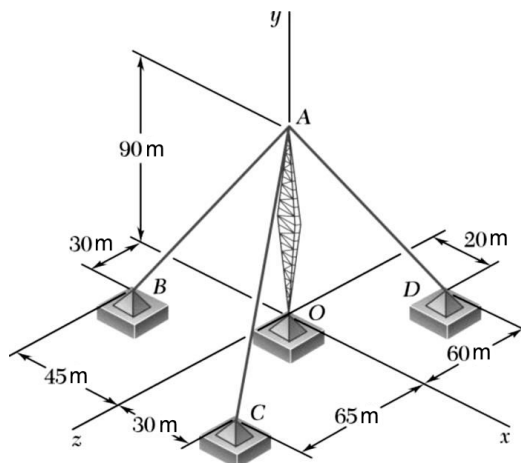two forces.

Figure 3

23   The bracket BCD is hinged at C and attached to a control cable at B as   **(12)**
shown. For the loading shown in figure 4, determine (a) the tension in the
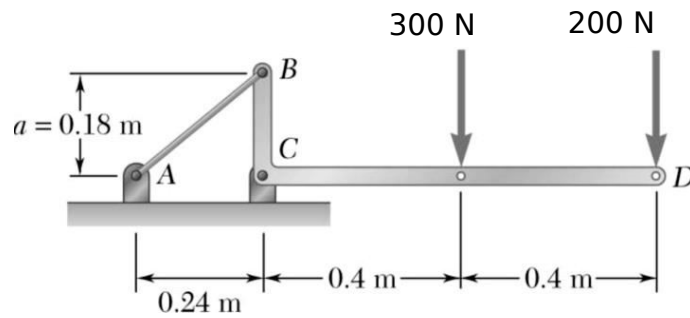cable, (b) the reaction at C.

300 N   200 N

Figure 4

24   Determine the centroid for the section shown in figure 5.   **(12)**
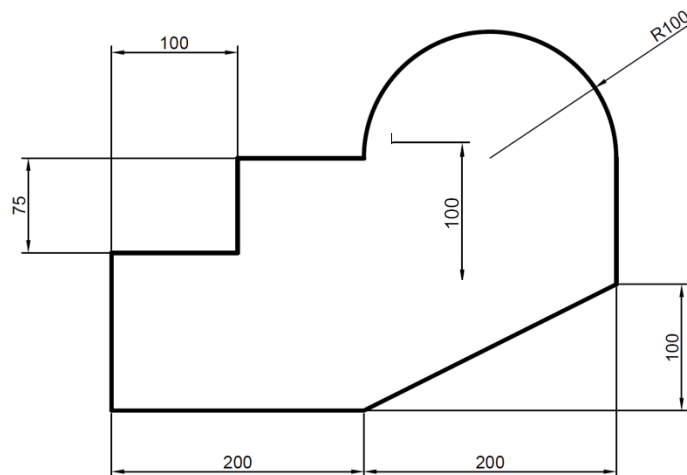

Figure 5

25   A cord connects two bodies of weights 250 N and 750 N. The two bodies are placed on an inclined plane and cord is parallel to inclined plane. The co-efficients of friction for the weight of 250 N is 0.15 and that for 750 N is 0.3. Determine the inclination of the plane to the horizontal and the tension in the cord when the motion is about to take place, down the inclined plane. The body weighing 250 N is below the body weighing 750 N.   **(12)**

26   A ladder 6 m long and of 280 N weight is placed against a vertical wall in a position where its inclination to the vertical is 35°. A man weighing 700 N climbs the ladder. At what position will be induce slipping, the co-efficient of friction for both the contact surfaces of the ladder with the wall and floor is 0.3.   **(12)**

27   Two blocks shown in figure 6, have masses A = 20 kg and B = 10 kg and the coefficient of friction between the block A and the horizontal plane, μ = 0.25. If the system is released, from rest, and the block B falls through a vertical distance of 1m, what is the velocity acquired by it? Neglect the friction in the pulley and the extension of the string.   **(12)**
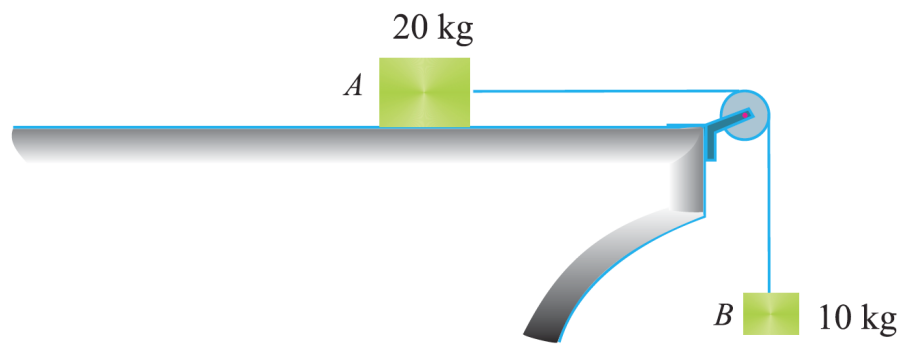
20 kg

A

B   10 kg

Figure 6

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SEMESTER END EXAMINATION - AUGUST 2021

Programme & Branch	:	**B.Tech. Auto, Aero & Mech**
Semester	:	II

Date & Session : 06/08/2021 FN

Course Code & Name	:	PHCX 01 & Fundamentals of Engineering Materials
Duration	:	120 minutes

Maximum Marks : 100

ANSWER ALL QUESTIONS

PART A (20 X 2 = 40 MARKS)

1. On the basis of band theory, how will you classify the metals on the basis of electrical conductivity?
2. Use the Fermi distribution function to obtain the value of $F(E)$ for $E-E_F = 0.01eV$ at 200K.
3. Give any four properties of semiconductors.
4. What is the difference between intrinsic and extrinsic semiconductor?
5. Mention the applications of conducting polymers.
6. Define dielectric polarization.
7. Mention the applications of dielectric materials.
8. Define dielectric constant.
9. List out the different types of polarization occurring in the dielectric materials.
10. What is ferroelectric material?
11. What is the origin of magnetism?
12. Write down the expressions for magnetization and magnetic permeability.
13. What is Bohr Magneton?
14. Define coercivity and retentivity.
15. Mention the applications of ferrite materials.
16. What are nanoparticles?
17. Mention the different forms of nanomaterials.
18. List out the methods of synthesis of nanomaterials.
19. What are the different structures of Carbon Nano Tubes (CNT)?
20. Mention any four applications of nanomaterials.

PART B (3 X 20 = 60 MARKS)
Answer any THREE questions

21.   Obtain the equation for the density of states in metal and hence deduce the expression for its carrier concentration.   **(20)**

22.   Deduce an expression for the carrier concentration of n - type semiconductor and explain the variation of Fermi energy with temperature and impurity concentration.   **(20)**

23.   What is meant by local field in a dielectric and how is it calculated? Deduce the Clausis-Mosotti relation.   **(20)**

24.   (i)   Describe the theory of diamagnetism and paramagnetism.   **(10)**

(ii)   Discuss in detail about the domain theory of ferromagnetism.   **(10)**

25.   (i)   Explain about the physical and magnetic properties of nanomaterials.   **(10)**

(ii)   Describe about the properties and applications of Carbon Nano Tubes (CNT).   **(10)**

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SEMESTER END EXAMINATIONS–AUGUST2021

Programme & Branch : B. TECH (COMMON TO ALL BRANCHES Except Bio-Tech)

Semester   : II   Date & Session   : 16/08/2021& FN

Course Code & Name   : MAC1281 ADVANCED CALCULUS

Duration   : 150 Minutes   Maximum Marks   : 100

PART A (20 X 2 = 40 MARKS)

Answer all the Questions

1. Find the limits of $\iint f(x, y)dxdy$ over the triangle bounded by $x = 0, y = 0, x + y = 6$.

2. Write any two applications of multiple integrals.

3. Evaluate $\int_0^1 \int_0^2 \int_0^3 dx dy dz$.

4. Change into polar coordinates: $\int_0^2 \int_0^x f(x, y)dydx$.

5. Evaluate $\int_0^\infty x^5 e^{-x^5} dx$.

6. Prove that $\frac{\beta(m+1,n)}{m} = \frac{\beta(m,n+1)}{n}$.

7. Write any two uses of beta and gamma integrals.

8. Find the maximum directional derivate of $\emptyset = x^2 y^2 z^4$ at (3, 1, -2).

9. If $\vec{F} = x^2 z \vec{i} - 3z^2 \vec{j} + 3xy^2 z \vec{k}$, find $\nabla \cdot \vec{F}$.

10. If $\nabla \emptyset$ is solenodal find $\nabla^2 \emptyset$.

11. State Gauss Divergence theorem.

12. What is a conservative vector field?

13. Find a unit vector normal to the surface $x^2 + y^2 - z = 10$ at (1,1).

14. Find $\iint \vec{r} \cdot \overrightarrow{ds}$ over the surfaceS of the tetrahedron whose vertices are (0,0,0) (1,0,0) (0,1,0) (0,0,1).

15. State the sufficient condition for the function f(z) to be analytic.

16. Show that $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ is harmonic.

17. Write any two properties of analytic function.

18. State Cauchy's Residue integral theorem.

19. Determine the poles of $f(z) = \dfrac{z}{(z-1)(z+2)}$.

20. State Taylor's theorem.

PART B (5 X 12 = 60 MARKS)
Answer any Five Questions

21. Find the smaller of the areas bounded by $x+y = 2$ and $x^2 + y^2 = 4$ **(12)**

22. Using Beta and Gamma functions evaluate $\iint_A xy\,dxdy$ where A is the area enclosed $by\ x = 0,\ y = 0\ and\ x + y = 1.$ **(12)**

23. (i) Show that the following vector is irrotational and find its scalar potential **(6)**

$$\vec{F} = (6xy + z^3)\vec{i} + (3x^2 - z)\vec{j} + (3xz^2 - y)\vec{k}.$$

(ii) If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $r = |\vec{r}|$, then prove that **(6)**

(i) $\nabla r = \dfrac{\vec{r}}{r}$, (ii) $\nabla r^n = nr^{n-2}\,\vec{r}$.

<MAC 1281>

24. (i) Find curl(curl $\vec{F}$) and div (curl $\vec{F}$), for the following vector; **(6)**

$$\vec{F} = x^2 y\hat{i} - 2xz\hat{j} + 2yz\hat{k}.$$

(ii) Find the directional derivative of $\Phi = xy + yz + zx$ in the **(6)** direction of $3\vec{i} + 4\vec{j} + 5\vec{k}$ at (1, 2, 3).

25. Verify Green's theorem in the plane for $\oint_C (x^2 + y)dx - xy^2 dy$ **(12)** where C is closed curve boundary of the square whose vertices are by the region $(0,0), (1,0), (0,1)$ $and (1,1)$.

26. Find the bilinear transformation which maps the points **(12)** $z_1 = 1, \ z_2 = i, \ z_3 = -1$ into the point

$w_1 = 2, \ w_2 = i, \ w_3 = -2$ respectively.

27. Evaluate using Cauchy Residue Theorem **(12)**

$\int_C \frac{\cos \pi z^2 + \sin \pi z^2}{(z-1)(z-2)} dz$, where $|z| = 3$.

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SEMESTER END EXAMINATIONS – AUGUST 2021

Programme & Branch	:	**B.Tech (All branches, including Arrear and Redo)**		
Semester	:	**II**	**Date & Session**	: **13/08/2021; FN**
Course Code & Name	:	**GEC1212 &Environmental Studies**		
Duration	:	**120 Minutes**	**Maximum Marks**	: **100**

PART -A (20 X 2 = 40 Marks)
### Answer ALL the Questions

1. Give an example for international and national water conflict.
2. Write any four important benefits of dams.
3. Define watershed management.
4. List out any four causes for desertification.
5. Define nutrition and malnutrition.
6. What are the types of food chain? Give an example.
7. How energy flow occurs in an eco-system?
8. Classify the biotic components with an example.
9. Define in-situ and ex-situ conservation.
10. Write any two important hot-spots of biodiversity in India.
11. How does coral reefs affect the marine environment?
12. Name instruments involved in the control of air pollution.
13. Classify the waste with suitable examples.
14. How do you keep the environment clean? Suggest.
15. What are the ill effects of fireworks?
16. Give examples for bell, urn and pyramid shape variation of population.
17. Name few of water-borne and air-borne diseases.
18. Define mortality and natality.
19. What is human rights?
20. Define sustainable development.

PART-B (3 X 20 = 60 Marks)

Answer ANY THREE Questions

21. (i) Describe the impacts of using fertilizers and pesticides. **(10)**

     (ii) Point out the uses of minerals and impacts of extraction of minerals. **(10)**

22. (i) With help of the given picture: Identify the type of ecosystem, write the **(10)**
         characteristics, structure and function of that ecosystem.
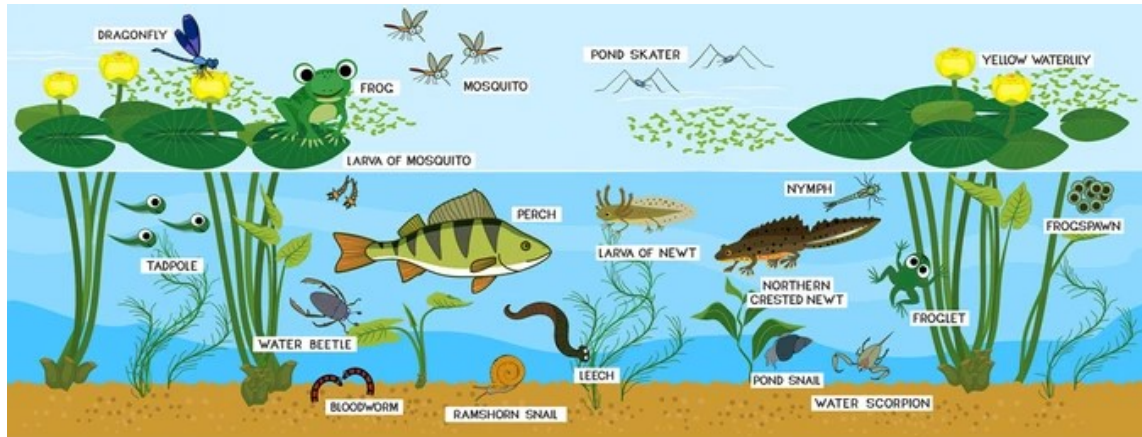
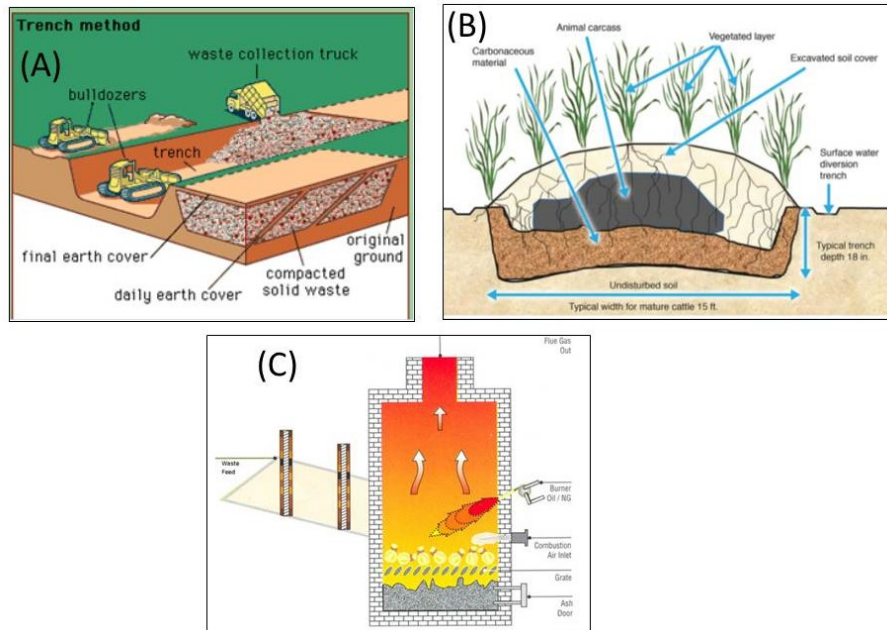   (ii) Describe the various uses of biodiversity with an example. **(10)**

23. (i) With the help of the given image, identify the type of pollution. Describe the **(10)**
         causes, effects and control measures of it.
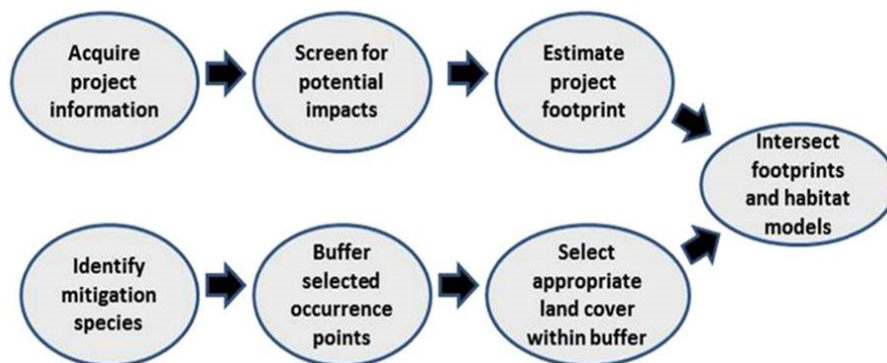

     (ii) With the help of the given figure, identify and name the methods of (A), (B) and **(10)**
         (C). Explain each of the process with merits and de-merits.

24. (i) With the help of the given flowchart, identify the process. Describe the **(10)** objectives, steps and benefits of it.

(ii) Identify the acts are implemented and amended in the years 1972, 1983, **(10)** 1986 and 1980, 1988. Write important objectives and features of it.

25. (i) "On 18th July 2021, business capital of India records over 200mm rainfall **(10)** overnight: landslips, wall collapse and 31 killed". Identify the disaster. Discuss the causes, effects and suitable mitigating measures of it.

(ii) Define the following terms: **(10)**

(a) over grazing and salinity (b) ecological succession and ecological pyramids

(c) nuclear pollution and tsunami (d) population growth and population explosion

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SEMESTER END EXAMINATIONS   AUGUST 2021

Programme & Branch   : B.Tech Common to EEE, EIE & POLYMER

Semester   : II   Date & Session   : 06/08/2021 FN

Course Code & Name   : PHCX 05 Materials Science

Duration   : 120 minutes   Maximum Marks   : 100

PART A (20 X 2 = 40 MARKS)
Answer all the Questions

1.   Draw the energy band diagram of conducting and semiconducting materials.

2.   Define Fermi energy. What is its physical significance?

3.   Use Fermi function to obtain the value of F(E) for $E-E_F$ = 0.015 eV at 200 K.

4.   Distinguish between elemental and compound semiconductors.

5.   How does the conductivity vary with temperature in a semiconductor?

6.   What is meant by mobility of a charge carrier?

7.   What is meant by polarization in dielectrics?

8.   Calculate the electronic polarisability of argon atom. Given ε_r = 1.0024 at NTP and the number of atoms per unit volume (N) is = 2.7×10^{25} atoms / m^3.

9.   Define dielectric loss and loss tangent.

10.   List any four applications of dielectric materials.

11.   Define magnetic flux density.

12.   Define magnetic susceptibility.

13.   What is Bohr Magneton?

14.   What do you mean by energy product of a magnetic material?

15.   Differentiate between coercivity and retentivity.

16.   What are direct bandgap semiconductors? Give an example.

17.   Write a note on exciton.

18.   Calculate the wavelength of radiation emitted by a LED made up of GaAs with bandgap energy of 1.52 eV.

19.   Distinguish between fluorescence and phosphorescence.

20.   What is an electro optic effect?

PART B (3 X 20 = 60 MARKS)
Answer any three Questions

21.	Derive expressions for density of electron in the conduction band and density of holes in the valence band and hence obtain the expression for intrinsic carrier concentration.	**(20)**
22.	Define internal field, Obtain the expression for internal field in a dielectric material using Lorentz method and hence deduce the Clausius-Mosotti equation	**(20)**
23. (i)	With a neat sketch, explain the domain theory of ferromagnetism.	**(10)**
(ii)	Describe the structure of ferrites and mention its applications.	**(10)**
24. (i)	Discuss the principle, construction and working of light emitting diode and semiconductor laser diode with suitable diagrams.	**(16)**
(ii)	List out the differences between LED and LCD.	**(4)**
25. (i)	Derive an expression for density of energy states and using that obtain an expression for Fermi energy of metal at absolute temperature.	**(12)**
(ii)	Differentiate between hard and soft magnetic materials.	**(8)**

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PART A (20 X 2 = 40 MARKS)
Answer all the Questions

1. Form the partial differential equation by eliminating the arbitrary constants a & b from $z = ax + by + a^2 + b^2$.

2. Find the general solution of $\dfrac{\partial^2 z}{\partial x^2} = 0.$

3. Find the particular integral of the 2nd order PDE
$(D^2 - 4DD' + 5D'^2)z = e^{-x}.$

4. State the Dirichlet's condition for a Fourier series.

5. Find the Fourier coefficient a_n, if $f(x) = x^3, \ -2 \le x \le 2.$

6. Define the harmonic analysis.

7. Obtain the R.M.S value for the function $f(x) = x$ in $(-\pi, \pi)$.

8. Verify whether the Fourier transform of $f(x) = 1,$ if $0 < x < \infty$ exists or not.

9. What is the Fourier transform of $f(x - a),$ if the Fourier transform of $f(x)$ is $F(s)$?

10. If $\dfrac{1}{\sqrt{s}}$ is the Fourier transform of $f(x),$ then find the Fourier transform of $x f(x).$

11. A rod **10cm** long with insulated sides has its ends A and B kept at $30^{\circ}C$ and $50^{\circ}C$ respectively. Find the steady state temperature distribution of the rod.

12. Classify the partial differential equation $xu_{xx} - 4u_{xy} + u_{yy} + 2u_x - u_y = 0.$

13. What is the constant term in the one dimensional heat equation?

14. Verify whether the function $f(x) = e^{ax}$ is an exponential order or not.

15. Find the laplace transform of $e^{-t}\sin 2t.$

16. Find the inverse Laplace transform of $\dfrac{1}{(s-4)^2}.$

17. Verify the final value theorem, if $f(x) = 2e^{-2x}.$

18. Find $Z^{-1}\left\{\dfrac{z}{z-a}\right\}.$

19. If $F(z) = \dfrac{2z}{(z-2)^2}$ is a Z–transform of $f(t),$ then find $f(0).$

20. Find the difference equation generated by $y_n = a - b3^n.$

PART B (5 X 12 = 60 MARKS)
Answer any Five Questions

21. Solve the partial differential equation **(12)**

$$\frac{\partial^2 z}{\partial x^2} - 7\frac{\partial^2 z}{\partial x\partial y} + 6\frac{\partial^2 z}{\partial y^2} = e^{2x+y} + \sin(x+2y).$$

22. Find the Fourier series of period $2L$ for the function $f(x) = |x|$ in **(12)** $-L \le x \le L$ and hence prove that $\displaystyle\sum_{n=1}^{\infty}\frac{1}{(2n-1)^4} = \frac{\pi^4}{96}.$

23. Compute first three harmonics of the Fourier series of $f(x)$ given by the following table. **(12)**

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
y	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

24. Find the Fourier transform of $f(x) = \begin{cases} a - |x|, & \text{if } |x| < a \\ 0, & \text{if } |x| > a \end{cases}$ **(12)**

and hence evaluate $\displaystyle\int_0^\infty \left(\frac{\sin x}{x}\right)^4 dx$.

25. A string of length **100 cm** is fixed at both ends. It starts vibrating from **(12)** the position $y = 4x(100 - x)$ at $t = 0$ while the initial velocity is zero. Find the displacement function at any time t and at distance x.

26. (i) Find the Laplace transform of $t\, e^{-2t} \cosh 3t$. **(6)**

(ii) Find the inverse Laplace transform of $\log\left(1 + \dfrac{a^2}{s^2}\right)$. **(6)**

27. Solve the difference equation $y_{n+2} + 3y_{n+1} + 2y_n = 2^n$ given that **(12)** $y_0 = 0 = y_1$, using Z – transform.

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SEMESTER END EXAMINATIONS– AUG 2021

Programme& Branch : B.Tech- AI & DS

Semester : II   **Date & Session** : 21/08 /2021 & FN

Course Code & Name : CSC1253 & Digital Logic Design

Duration : 150 Minutes   **Maximum Marks** : 100

PART A (20 X 2 = 40 MARKS)
Answer all the Questions

1. What is the binary equivalent of the decimal number 567?

2. Simplify the Boolean equation f=A(B+C)(A+B)

3. Convert the hexadecimal 9AF.F to binary.

4. What is the binary equivalent of the decimal number 478?

5. Subtract 110 from 1011 using 2's complement method.

6. State identity law.

7. Convert binary to gray code for 1101010001

8. Reduce A+(BC)+(AB)

9. Perform the BCD addition for numbers : $(12)_{10}(8)_{10}$

10. Write the data flow description of a 2-to -1 multiplexer using a conditional operator.

11. How many select lines will a 16 to 1 multiplexer will have?

12. Define Demultiplexer.

13. Derive the characteristics equations of a T flip flop.

14. Distingush between latches and flipflop.

15. What is the use of clock pulse in sequential circuits?

16. Define asynchronous counters.

17.   What is the drawback of SR flip flop?

18.   State any two applications of shift register.

19.   Name the different types of counters.

20.   Differentiate static hazard and dynamic hazard.

PART B (5 X 12 = 60 MARKS)
Answer any Five Questions

21	(i)	Find the minimal SOP expression for $F(W,X,Y,Z)= m(0,1,2,5,6,7,8,9,10,14)$ using K-Map method.	**(12)**
22	(i)	Explain the method used in construction of half and full adder.	**(12)**
23	(i)	Write the rules for addition of two numbers using r's and (r-1)'s complement.	**(4)**
	(ii)	Obtain the 2's complement for the following binary numbers. A) 1001110 B) 1001100. Subtract A from B using 1's and 2's complement	**(8)**
24	(i)	Explain with necessary diagram the RS, JK, D and T flip flop and mention its truth table.	**(12)**
25	(i)	Explicate about encoder and decoder with neat diagram.	**(12)**
26	(i)	Design and explain 4 bit binary Ripple Counter using T flip flop .	**(12)**

27   (i)   Draw the state diagram for the given table. Reduce the state table by applying implication table method write the reduced state table and draw the reduced state diagram.

Present State	Next State		Output	
	X=0	X=1	X=0	X=1
a	d	a	0	0
b	e	a	0	0
c	g	f	0	1
d	a	d	1	0
e	a	d	1	0
f	c	b	0	0
g	a	e	1	0

(12)

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SEMESTER END EXAMINATIONS– JULY 2021

Programme & Branch   :   **B.Tech(Common to all branches)**

Semester   :   **IV**   Date & Session   :   **06/07/2021, AN**

Course Code & Name   :   **SSCX06, Law For Engineers**

Duration   :   **120 Minutes**   Maximum Marks   :   **100**

PART A (20 X 2 = 40 MARKS)
Answer all the Questions

1.   Define the Preamble of Indian Constitution.

2.   Why does a democratic country need a Constitution?

3.   Differenciate between fundamental rights and directive principles.

4.   What is the importance of Article 21A of the Constitution of India? Explain.

5.   Write any two differences between Rajya Sabha and Lok Sabha

6.   What is the importance of Article 17 of the Constitution of India? Explain.

7.   Write any two differences between agreement and contract

8.   List out the modes of acquiring citizenship in India.

9.   Write down the three powers of the President.

10.   Define Information according to RTI Act 2005.

11.   What is meant by Human Rights?

12.   Write any two differences between agreement and contract.

13.   What are the information that is exempted from disclosure under RTI Act?

14.   Write the five categories of Human rights.

15.   Define New Citizenship Amendment Act (CAA) 2019.

16.   Distinguish between strike and lockout under Industrial Disputes Act, 1947.

17.   Illustrate any two types of contracts.

18.   Expand the following: TRIPS and WHO.

19.   What is a trademark?

20.   What is Patent?

PART B (3 X 20 = 60 MARKS)

Answer any Three Questions

21   (i)   Explain in details the fundamental rights of Indian citizens.   **(10)**

(ii)   Critically examine the various outstanding featutes of Indian Constitution.   **(10)**

22   (i)   Enumerate the fundamental duties of Indian citizens.   **(10)**

(ii)   What are the various principles grouped under the Directive Principles of State Policy?   **(10)**

23   (i)   "Human Rights are the rights inherent human beings" discuss the statement with various characteristics of Human Rights?   **(10)**

(ii)   "RTI Act 2005 resulted into the transparency of Governance in India". Explain the statement with respect to the objectives of RTI Act 2005.   **(10)**

24   (i)   What are the matters to be provided for in the standing orders under the Industrial Employment (Standing Orders) Act 1946?   **(10)**

(ii)   What do you mean by the term Contract? What are the essential elements of a Valid Contract?   **(10)**

25   (i)   Discuss various tools covered under Intellectual Property Rights (IPR).   **(10)**

(ii)   What is TRIPS Agreement? Outline the main three features of the TRIPS Agreement.   **(10)**

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SEMESTER END EXAMINATIONS– JULY 2021

Programme & Branch	:	**B.Tech(Common to all branches)**			
Semester	:	**IV**	**Date & Session**	:	**06/07/2021,AN**
Course Code & Name	:	**SSCX05, Industrial Sociology**			
Duration	:	**120 Minutes**	**Maximum Marks**	:	**100**

PART A (20 X 2 = 40 MARKS)
Answer all the Questions

1. Define Industrial Sociology.
2. List out any three objectives of studying Industrial sociology.
3. What are the economic and non-economic causes of Industrial disputes?
4. List down the features of Pre-machine age.
5. What are the main reasons for joining trade union?
6. List out any three impacts of automation.
7. Define Blue-collar job.
8. Draw the flow chart for line organization.
9. List any three characteristics of values.
10. What is decoding in communication process?
11. Define mosaic plagiarism.
12. What is task group.
13. Explain the term "storming "in the process of group formation.
14. What is work ethics?
15. List any two purposes of Communication.
16. Define service-learning.
17. What are different types of formal group.
18. What is job satisfaction?
19. Define Leadership.
20. Define mass production.

PART B (3 X 20 = 60 MARKS)
Answer any Three Questions

21 (i)   Explain the scope and importance of Industrial Sociology.   **(10)**

     (ii) Explain the advantages and disadvantages of line organisation.   **(10)**

22 (i)   Define Strike. Explain the various types of strike in Industrial Organisation.   **(10)**

     (ii) Define trade union and explain the various objectives and functions of trade union in Industrial Organization.   **(10)**

23 (i)   Explain the role and functions of supervisor in Industrial Organization.   **(10)**

     (ii) Differentiate between Fordism and Post Fordism   **(10)**

24 (i)   Explain the different stages involved in the formation of group in Industrial Organizations. **(10)**

     (ii) Explain the communication process in detail with suitable diagram.   **(10)**

25 (i)   Explain the various barriers of an effective communication process in working organization.   **(10)**

     (ii) Define Plagiarism. Explain the various types of plagiarism withsuitable examples.   **(10)**

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SEMESTER END EXAMINATIONS– JULY 2021

Programme & Branch   :   B.Tech(Common to all branches)

Semester   :   IV   Date & Session   :   06/07/2021, AN

Course Code & Name   :   SSCXO4 – Economics of Sustainable Development

Duration   :   120 Minutes   Maximum Marks   :   100

PART A (20 X 2 = 40 MARKS)
Answer all the Questions

1. Write any two differences between traditional engineering and sustainable engineering.
2. Define the concept of sustainable development according to Brundtland Report.
3. What are the outcomes of Rio+20?
4. What is the main objective of Rio Earth Summit?
5. What are the primary goals of sustainable development?
6. Why is sustainable development so often associated with protecting the environment?
7. Distinguish between economic globalization and sustainable globalization.
8. As a future engineer, can you suggest any one strategy that you could adopt to meet the sustainability benchmarks?
9. Suggest any four changes that you would like to incorporate in the life style of students of your age to move towards a sustainable use of available resources.
10. What is Agenda 21?
11. Write two advantages of Precautionary Principle.
12. Write two disadvantages of Precautionary Principle.
13. What is Kyoto Protocol?
14. Identify any two principles of Rio Declaration intended to guide future sustainable development around the world.
15. What is the need of sustainable development?
16. What do you mean by Ozone Layer Depletion?
17. Write about the impact of globalization on sustainability of economies.
18. Name some environmental issues in India.
19. Can you name the various steps the government of India has taken to safeguard the environment.
20. Recognize any two principles set out in the Business Charter for Sustainable Development.

PART B (3 X 20 = 60 MARKS)

Answer any Three Questions

21 (i) The three pillars of sustainability are a powerful tool for defining the complete sustainability problem. Discuss. **(10)**

(ii) What is Montreal Protocol? Has the Montreal Protocol been successful in reducing ozone-depleting gases in the atmosphere? **(10)**

22 (i) Identify the big global environmental issues we need to resolve by 2030. **(10)**

(ii) As a future engineer, what measures you would suggest to overcome these challenges? **(10)**

23 (i) Discuss a few market based policy instruments for controlling pollution. **(10)**

(ii) What are the objectives and aims of Basel Convention? Which plastic wastes are currently subject to control under Basel Convention? **(10)**

24 (i) What do you mean by Polluter Pays Principal? What are the advantages and disadvantages of this principle? **(10)**

(ii) Discuss the importance of cooperation and partnership in sustainable development with reference to Globalization and Global Governance **(10)**

25 (i) What are the challenges of developing nations for initiating green economy? **(10)**

(ii) What are the green practices nations can adopt for initiating green economy? **(10)**

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SEMESTER END EXAMINATIONS – JULY 2021

Programme & Branch   :   B.Tech – Common to all branches except Bio-Technology

Semester   : VI   Date & Session   : 07/07/2021 & AN

Course Code & Name   :   MACX07 – Numerical methods for integral and differential equations

Duration   : 120 Minutes   Maximum Marks   :   100

PART A (20 X 2 = 40 MARKS)
Answer all the Questions

1. Find the area bounded by the curve passing through the points (0, 1), (1, 2), (2, 3), (3, 4), the X- axis and ordinates x = 0 and x = 3 using Trapezoidal rule.

2. What is the restriction in the number of ordinates, required for using the Simpson's three eighth rule for integrating $\int_a^b f(x) \, dx$?

3. Define Trucation error.

4. What is the error in Simpson's one third rule?.

5. Define round of error.

6. State Gaussian two point quadrature formula.

7. Define mechanical quadrature

8. What is Predictor-Corrector method?

9. State Adams Bashforth corrector formula.

10. How many prior values are required to predict the next value in Milne's method?

11. Express $\frac{dy}{dx}$ in terms of finite difference equation.

12. Define initial value problem

13. Classify the partial differential equation $u_{xx} - 4u_{xy} - u_{yy} - u_x = 0$

14. Write the formula for u_{yy} in terms of difference quotients.

15. Write down the standard five point formula in solving Laplace equation.

16. What is the purpose of Liebmann's process?

17. Write down the difference scheme for solving the Poisson's Equation

18. Name two methods that you use to solve one dimensional heat equation.

19. Express $u_{xx} = u_{tt}$ in terms of difference quotients.

20. State Bender Schmidt recurrence formula

PART B (3 X 20 = 60 MARKS)
Answer any Three Questions

21 (i) Evaluate $\int_0^1 \frac{1}{1+x^2}$ dx correct to three decimal places using Romberg's method. **(10)**

    (ii) By dividing the range in to 10 equal parts, evaluate $\int_0^\pi sinx\, dx$ using Simpson's one third rule. **(10)**

22 (i) The velocity v of a particle at distance S from a point on its path is given by **(10)**

S: 0   10   20   30   40   50

V: 47   58   64   65   61   52

Estimate the time taken to travel 50 meters by using Simpsons three eighth rule.

    (ii) Evaluate $\int_0^2 \frac{1}{1+x}\, dx$ using Gaussian Quadrature three point formula. **(10)**

23 (i) Evaluate $\int_0^1 \int_0^1 \frac{1}{x^2 + y^2 + 1}$ dx dy using Simpsons rule with $h = k = 0.2$ **(10)**

    (ii) Evaluate $\int_0^1 \int_1^{2.5} \frac{1}{\sqrt{x^2+y^2}}\, dx\, dy$ using Trapezoidal rule with $h = 0.25$ and $k = 0.2$ **(10)**

24 (i) Given that $y' = \frac{1}{x^2} - \frac{y}{x}$, $y(1) = 1$, $y(1.1) = 0.996$, $y(1.2) = 0.986$ and $y(1.3) = 0.972$, find the value of $y(1.4)$ using Milnes Preictor-corrector formula. **(10)**

    (ii) Solve the equation $5xy' = 2 - y^2$ for $y(4.5)$ using Adams method, given that $y(4) = 1, y(4.1) = 1.0049$, $y(4.2) = 1.009$, $y(4.3) = 1.0143$ and $y(4.4) = 0.972$. **(10)**

25   (i)   Solve the Poisson equation $\nabla^2 u = 8x^2 y^2$ over the square with sides   **(10)**

$x = 0, y = 0, x = 3 \ and \ y = 3$ with $u = 0$ on the boundary and mesh length h = 1.

    (ii)   Solve $u_{xx} = u_t$ given that $u(0,t) = u(5,t) = 0$ & $u(x,0) = x^2(25 - x^2)$.   **(10)**

Find u in the range taking h = =1 and upto 3 seconds using Bender Schmidt recurrence equation.

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SEMESTER END EXAMINATIONS–JULY 2021

Programme& Branch	:	**B.Tech (ECE, IT, CSE, EEE, AUTO, CIVIL)**		
Semester	:	**VI**	**Date & Session**	: **07/07/2021 & AN**
Course Code & Name	:	**MACX 09 GRAPH THEORY**		
Duration	:	**120 Minutes**	**Maximum Marks**	: **100**

PART A (20 X 2 = 40 MARKS)

#### Answer all the Questions

1. **What is a graph?**

2. **A graph is called regular if the degree of each vertex is equal. Draw a regular graph on 4 vertices.**

3. **When a vertex Q is connected by an edge to a vertex K what is the term for the relationship?**

4. **Define a walk with an example.**

5. **Draw a simple non – isomorphic graph on 4 vertices and 3 edges.**

6. **Draw a 13-vertex , 4-level binary tree.**

7. **What is the degree sequence of the given graph**
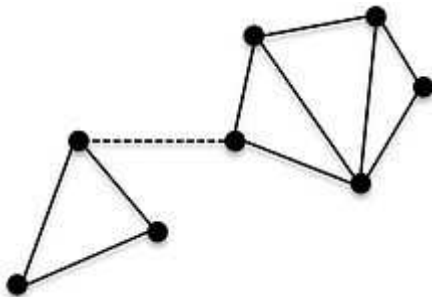
8. **Differentiate between Euler and Hamiltonian graph.**

9. **Define infinite graph.**

10. **Define rooted tree.**

11.   **Make the given graph disconnected by deleting minimal edges.**
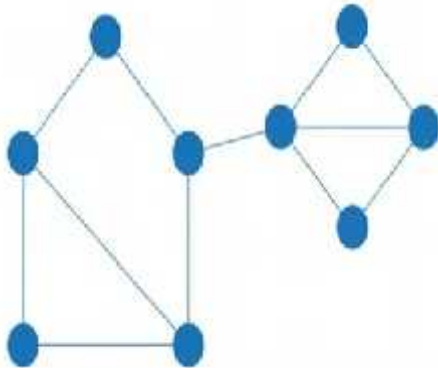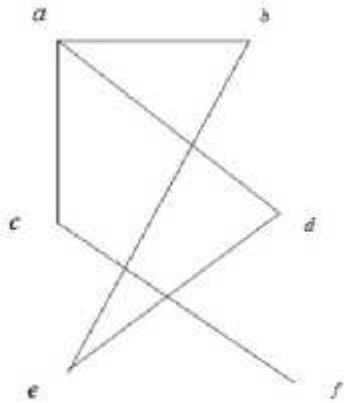

12.   **Draw a pseudograph.**

13.   **List few applications of Hamiltonian graph.**

14.   **Draw the Cartesian product $C_4 \times P_2$**

15.   **Draw a graph with two cut vertex.**

16.   **Identify the type of the graph**
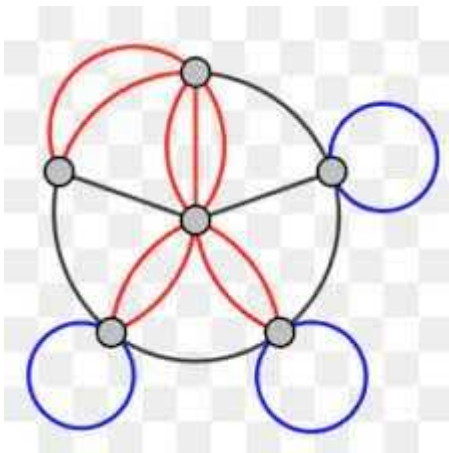
17.   **For which of the following combinations of the degree of vertices would the connected graph be Eulerian.**

    (a) 1, 2, 3

    (b) 2, 3, 4

    (c) 2, 4, 5

    (d) 1, 3, 5

    (e) None of these

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<MACX 09>

18.   **Define acyclic graph.**

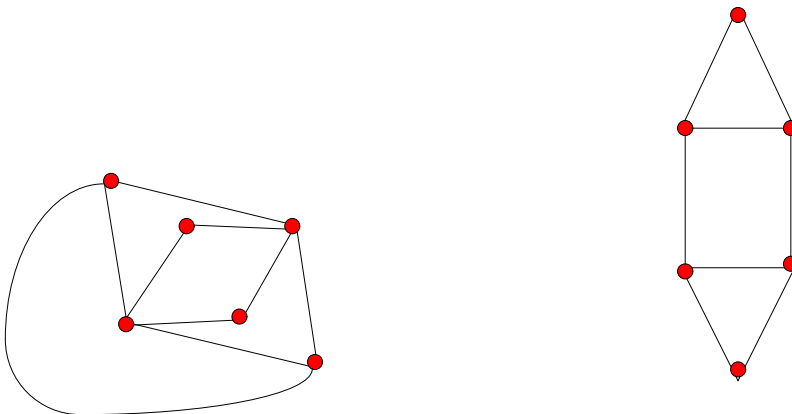19.   **Is this graph a Tree?**

20.   **Identify the ancestors and descendants of c_3.**
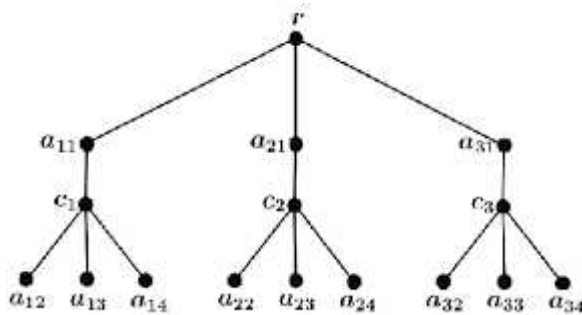

PART B (3 X 20 = 60 MARKS)

Answer any Three Questions

21   (i)   Verify whether two graphs *G* and *H* are isomorphic. Also comment on the behavior   (12) of the adjacency matrices of the two graphs.

(ii) Let $A = \{1,2,3,4,5\}$ and the relation set be R={ (a, b) / (a + b) is even}. Find the graph (8) associated to the given relation by taking A as the vertex set and R as the edge set. Also verify the handshaking theorem for the same.

**22 (i)** Find the distance matrix of the given graph (12)
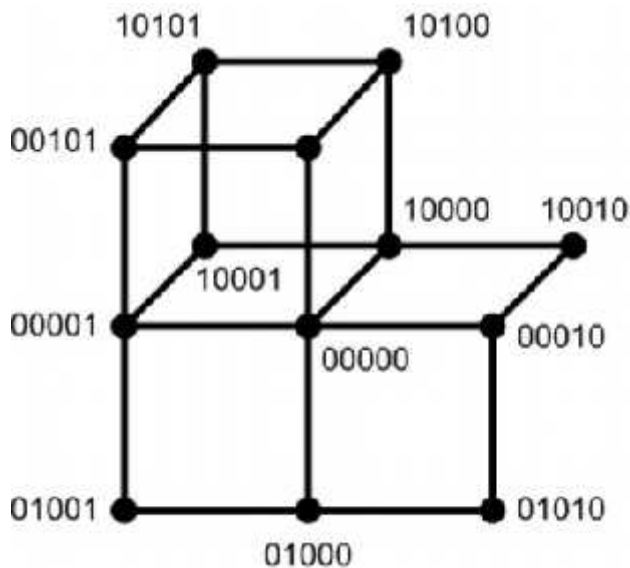
(ii) Suppose that we have a collection of 3- letter English words say ACT, AIM, ARC, (8) ARM, ART, CAR,CAT, OAR, OAT, RAT, TAR. We say that a word W_1 can be transformed into a word W_2 if W_2 can be obtained from W_1 by performing exactly one of the following two steps:

(1) Interchanging two letters of W_1.

(2) Replacing a letter in W_1 by another letter.

This situation can be modeled by a graph G where the given words are the vertices of G and two vertices are adjacent in G if the corresponding words can be transformed into each other.

23 (i) Find the spanning tree for the given graph using depth first search. Identify the (12) shortest path from 'a' to 'k'.
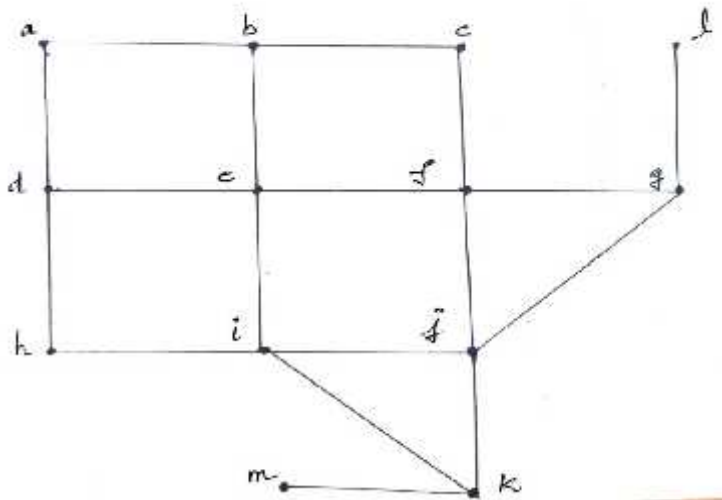
(ii) The diagram of the figure shows the nine rooms on the second floor of a large house   (8)
     with doorways between various rooms. Is it possible to start in some room and go
     for a walk so that each doorway is passed through exactly once. How is this question
     related to graph theory? Represent the given scenario as a graph.
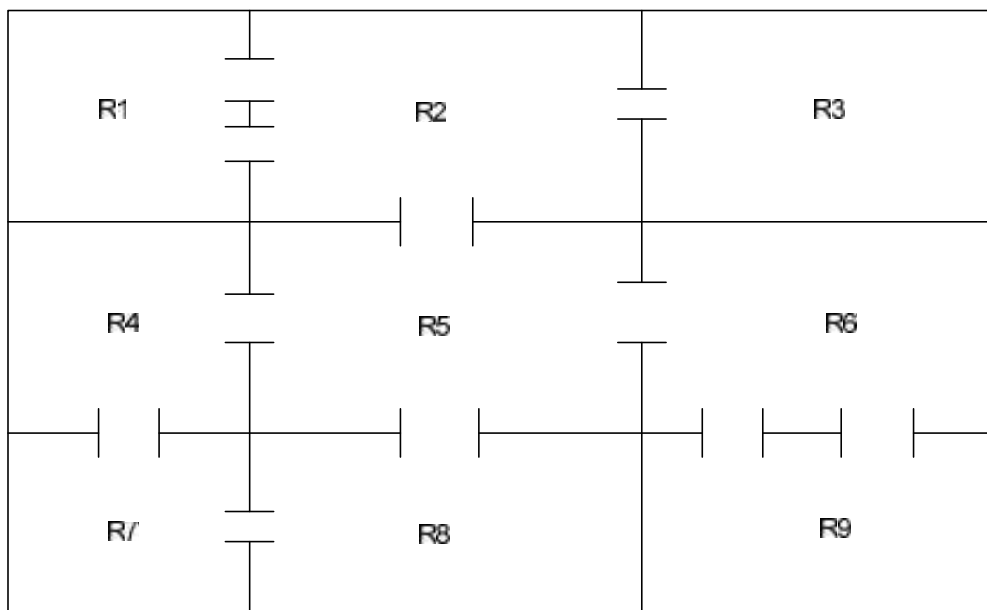
24   *Determine all the fundamental cutsets of the following graph.*   **(20)**
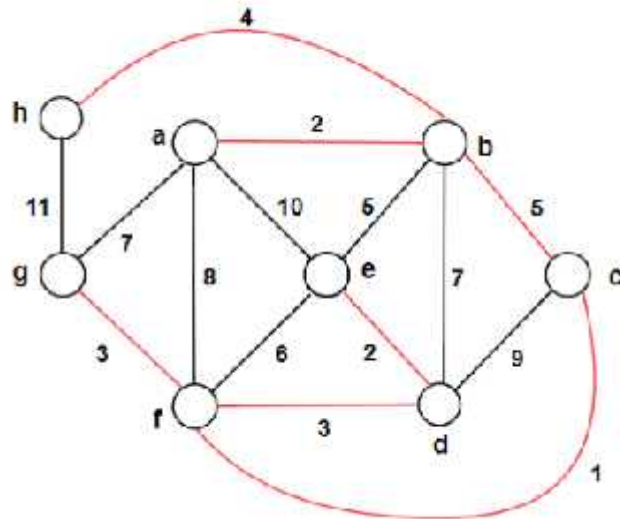
25   **Find the maximum flow through the given network using Ford Fulkerson algorithm.**   **(20)**

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SEMESTER END EXAMINATIONS - JULY 2021

Programme & Branch : **B.Tech – All Branches except Bio-Tech, EEE & Polymer**

Semester : **VI** Date & Session : **07/07/2021 AN**

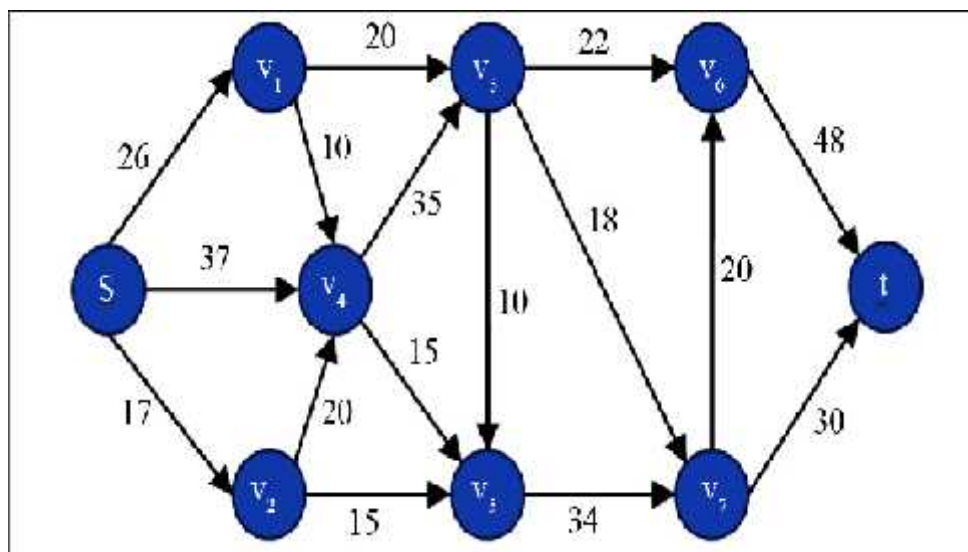Course Code & Name : **MACX 06 – Statistical Methods for Data Analysis**

Duration : **120 Minutes** Maximum Marks : **100**

<Statistical Table is permitted>

ANSWER ALL QUESTIONS

PART A (20 X 2 = 40 MARKS)

1. Which test is used when the sample size is less than 30? Why?
2. Define parameters and statistics.
3. Define null hypothesis in sampling.
4. What are the assumptions for conducting t-test?
5. Mention any two applications of F-test.
6. Distinguish between experimental and extraneous variables involved in design of experiment.
7. Explain briefly about Latin square design.
8. Write any two points by comparing Randomized block design and Latin square design.
9. Write down the format of ANOVA table for three factors of classification.
10. Draw the expected frequencies for the following 2 x 2 contingency table.

a	b
c	d

11. What do you mean by Statistical Quality Control?
12. What is the difference between chance variation and assignable variation?
13. What is control chart? Name the types of control charts.
14. Find the lower and upper control limits for $\bar{X}$ - chart and R – chart, when each sample is of size 4 and $\bar{\bar{X}} = 10.80$ and $\bar{R} = 0.46$.
15. When do you say the process is out of control?
16. When the sample size n is same for all the sample numbers, will the p – chart and np – chart lead to the same conclusions regarding the process of control?

17. Find the lower and upper control limits for p – chart and np – chart, when $n = 100$ and $\bar{p} = 0.085$.

18. When the process is under control and if $n = 5$, $\bar{\bar{X}} = 1.1126$ and $\bar{R} = 0.054$, find the tolerance limits.

19. Distinguish between control limits and tolerance limits.

20. Distinguish between p – chart and np – chart.

PART B (3 X 20 = 60 MARKS)

Answer any THREE questions

21. (i) A sample of 26 bulbs gives a mean life of 990 hours with a S.D. of 20 hours. The manufacturer claims that the mean life of bulbs is 1000 hours. Is the sample not up to the standard? **(10)**

(ii) The following table gives the number of aircraft accidents that occurred during the various days of the week. Test whether the accidents are uniformly distributed over the week. **(10)**

Days	Mon	Tue	Wed	Thu	Fri	Sat
No. of accidents	14	18	12	11	15	14

22. Three varieties A, B, C of a crop are tested in a randomized block design with four replications. The plot yields in pounds are as follows. **(20)**

A	6	C	5	A	8	B	9
C	8	A	4	B	6	C	9
B	7	B	6	C	10	A	6

Analysis the experimental yield and state your conclusion.

23. The following data gives the average life in hours and range in hours of 12 samples each of 5 lamps. Construct the control charts for $\bar{X}$ and R, comment on the state of control. **(20)**

Sample No.	1	2	3	4	5	6	7	8	9	10	11	12
$\bar{X}$	120	127	152	157	160	134	137	123	140	144	120	127
R	30	44	60	34	38	35	45	62	39	50	35	41

24. 10 samples of each of size 50 were inspected and the no. of defectives in the inspection was: 2,1,1,2,3,5,5,1,2,3. Draw np chart and p chart. Also compare **(20)**

both the charts and give your comment.

25   Analyze the following results of a Latin square experiments   **(20)**

	1	2	3	4
1	$A(12)$	$D(20)$	$C(16)$	$B(10)$
2	$D(18)$	$A(14)$	$B(11)$	$C(14)$
3	$B(12)$	$C(15)$	$D(19)$	$A(13)$
4	$C(16)$	$B(11)$	$A(15)$	$D(20)$

The letters A, B, C, D denote the treatments and the figures in brackets denote the observations.

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SEMESTER END EXAMINATIONS – JULY 2021

Programme & Branch	: B.Tech – Common to all branches		
Semester	: VI	Date & Session	: 07/07/2021 & AN
Course Code & Name	: MACX 08 – Mathematical Modeling		
Duration	: 120 Minutes	Maximum Marks	: 100

PART A (20 X 2 = 40 MARKS)
Answer all the Questions

1. Define the dependent and independent variables in the language of mathematical modeling.

2. Write any two significances of mathematical modelling.

3. What is the difference between the black box model and white box model?

4. Draw the schematic diagram of Modeling Process.

5. Let $P_{n+1} = P_n + P_{n-1}$ (for $n \geq 1$) be the mathematical formula of a population model with $P_0 = 1 = P_1$. Then find P_4.

6. Write the mathematical formula of SLR model.

7. Interpret the values of correlation coefficient (r) as 1, -1 and 0.

8. Draw the architecture of neural networks.

9. Define the activation function.

10. Draw network diagram from the following list of activities.

Activity	A	B	C	D	E	F	G	H
Predecessor Activity	---	A	B	B	C	D	E	F, G

11. What are the major stages in the process of mechanistic modeling?

12. Write any two advantages of mechanistic models.

13. What is the finite difference approximation of $\dfrac{du}{dt}$ at t_n?

14. Define the initial value problem and boundary value problem.

15. Write the mathematical model of Radiocarbon dating.

16. State the Newton's Law of Cooling.

17.   Define the closed form solution.

18.   Name the any two real-world problems, which gives the mathematical model in the form of parabolic partial differential equations.

19.   Classify the partial differential equation $y\dfrac{\partial^2 u}{\partial x^2}+\dfrac{\partial^2 u}{\partial y^2}=0.$

20.   What are the conditions to say an expression is a closed form expression?

PART B (3 X 20 = 60 MARKS)
Answer any Three Questions

21. (i)   Explain the following stages in mathematical modeling.   **(12)**
           a) Building
           b) Studying
           c) Testing
           d) Using

     (ii) Write a brief note on the types of mathematical models.   **(8)**

22.   A researcher did a wide range survey on age factor of Covid-19 deaths in the state of Tamil Nadu. He wants to know that weather the increased cases in the group of old age will lengthen the number of deaths or not, and a study is therefore performed in which the number of deaths is determined as a function of number of positive cases. The following data is found (assume that no noise in the data) :   **(20)**

Age Group (in years)	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
No. of Positive Cases (in 1000's)	20.7	48	133.6	126	114	103	59.7	23.8	5.8	0.5
No. of Deaths (in 1000's)	0.015	0.023	0.125	0.4	1	2.4	3.1	2.2	0.8	0.08

Then
    (i)   Draw roughly a scatter plot of the data.

    (ii) Fit the simple linear regression model.

    (iii) Does a simple linear regression model make sense for these data? Why or why not?

    (iv) According to the age groups, estimate the relationship between the number of positive cases and the number of deaths.

23. (i) What is neural network modeling? Derive the mathematical formula of neural network. **(10)**

(ii) Using following data, corresponding to the each input find the output of the voltage potential to activate the axon under the activation function **(10)**

$$f(\beta) = \frac{1}{1 + e^{-\beta}}.$$

Inputs / Layer's Weightage		Layer - 1	Layer - 2
Input – 1	0.35	0.15	0.4
Input – 2	0.9	0.81	0.6
Biases of Layers		0.32	0.89

24. A freshly brewed cup of coffee is set on the counter and has a temperature of 200° Fahrenheit. After 3 minutes, it has cooled to 190°F, but is still too hot to drink. If the room is 72°F and the coffee cools according to *Newton's Law of Cooling*. Then **(20)**

(i) Formulate the above problem into mathematical model.

(ii) Validate the solution of mathematical model.

(iii) Apply the mathematical model to find the waiting time of the impatient coffee drinker to drink the coffee with 165°F.

25. Suppose that a bungee-jumping company hires you. You're given the task of predicting the velocity of a jumper as a function of time during the free-fall part of the jump. Then **(20)**

(i) Develop the mathematical model to complete the given task.

(ii) Use the developed mathematical model to find the bungee jumper velocity for the first 12 seconds of free fall. Assume that the mass of bungee jumper is 68.1 kg and lumped drag coefficient is 0.25 kg/m.

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SEMESTER END EXAMINATIONS – JULY 2021

Programme & Branch : **B.Tech (Common to ECE, EEE, E&I, CSE and IT)**

Semester : **VI** **Date & Session** : **05/07/2021 - AN**

Course Code & Name : **MSC3182 – SOCIAL ENTREPRENEURSHIP**

Duration : **150 Minutes** **Maximum Marks** : **100**

PART A (20 X 2 = 40 MARKS)
Answer all the Questions

1. When a person is set to be in a state of "flow"?
2. Why and how effectuation influence the entrepreneurial process?
3. Mention the different entrepreneurship styles.
4. How do you understand the identified problem is worth solving?
5. List out steps involved in design thinking process.
6. What are the rules to be followed during brain stroming session?
7. Distingush between a customer and a consumer.
8. What are the elements of a value proposition canvas? Give an example.
9. Diffentiate a business plan from a busniness model.
10. What are the different types of risk?
11. Is red ocean stratergy a viable one? Give an example.
12. What are the differences between solution demo and MVP?
13. How to validate a product solution fit?
14. How to achieve product market fit?
15. Which method is better for a startup – Boostrapping or loan from a bank? Justify.
16. How to identify the roles for which hiring is needed?
17. What is called sales funnel?

18.   How the customer acquisition cost impact the business?

19.   How is a brand different from a product?

20.   How do businesses express this positioning?

PART B (5 X 12 = 60 MARKS)

Answer any Five Questions

21   Nikhil and Rohit were colleagues at one of the Big Fours. While Nikhil   **(12)**
        was a Chartered Accountant, Rohit lived and breathed software
        designing. Feeling stifled with the monotonous nature of their work,
        they decided to start something on their own. They quit their jobs and
        launched their own online Tax consulting services portal through which
        Nikhil took care of the actual front-end consulting while Rohit managed
        the back-end part of it - the website and the app. However, six months
        later, they realized that they had only three confirmed clients, resulting
        in an annual income of approx. Rs.51475. They had exhausted all
        their earlier savings of around Rs.205901, and desperately needed
        funds to keep their venture alive.

        Considering the above scenario, Identify and explain the effectuation
        principle used and missed in the above scenario. Also suggest a
        solution worth solving.

22   (i)   Explain the *five* segments of customers with example.   **(06)**

        (ii)   What are the types of Market for startup? Explain with example   **(06)**

23   Draw the skeleton of "Lean canvas", business model. Brief each block.   **(12)**

24   The IPL (Indian Premier League) was launched in 2008 by the BCCI   **(12)**
        (Board of Control for Cricket in India). Inspired by the English Premier
        League, the BCCI tapped into the unexploited domestic market of
        Indian cricket by introducing a new 20-20 format of the game
        combined with thrilling entertainment. IPL revolutionized the world of

Cricket by making the sport take a quantum leap in income generation and popularity, which shook the Cricketing world. It established India in a position of power, calling the shots at the ICC, until then dominated by Australia and England.

Explain the blue ocean Strategy adopted in the above case by providing the strategy canvas and 4 action frame work.

25 Explain the Autocratic, Shared, and Laissez-Faire Leadership styles stating the characteristics. **(12)**

26 Explain the *Seven Steps* of One to One selling. **(12)**

27 Brief your Practice Venture (PV) in few words. List Fixed Costs, Startup Costs, Variable Costs of your Practice Venture. Calculate the revenue of your PV, if your payback period is 12 months. **(12)**

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