UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE
(2013 SCHEME)

MODEL QUESTION PAPERS
FOR
COMBINED I & II SEMESTER

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.101 ENGINEERING MATHEMATICS - I (ABCEFHMNPRSTU)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

PART-A

*Answer **all** questions . **Each** question carries **4** marks.*

1. If $u = x^2 - 2y^2$, $v = 2x^2 - y^2$ and $x = rcos\theta$, $y = rsin\theta$, find the value of the Jacobian $\frac{\partial(u,v)}{\partial(r,\theta)}$
2. Evaluate $\lim_{x\to 0}(\frac{a^x+b^x}{2})^{1/x}$
3. Evaluate $L\left[\frac{e^{-4t}sin3t}{t}\right]$
4. Evaluate $\int_0^2 \int_o^z \int_0^{yz} xyz\, dx\, dy\, dz$
5. Find the rank of the matrix $A = \begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$

PART-B

*Answer **one full** question from **each** module. Each question carries **20** marks.*

MODULE 1

6. a) If y = $(x^2 - 1)^n$, prove that $(x^2 - 1)y_{n+2} + 2xy_{n+1} - n(n+1)y_n = 0$

   b) Find the radius of curvature at any point $P(x, y)$ of the curve $x^{2/3} + y^{2/3} = a^{2/3}$

7. a) Find the evolute of the parabola $x^2 = 4ay$

   b) Find the maxima and minima of $xy(\ a - x - y\ )$

MODULE II

8. a) Change the order of integration in $\int_0^1 \int_x^1 \frac{x}{x^2+y^2} dx\, dy$ and hence evaluate.

   b) Determine the area bounded by curves $xy = 2$, $x^2 = 4y$ and $y = 4$

9. a) Changing to polar and evaluate the double integral $\int_0^a \int_y^a \frac{x^2}{\sqrt{x^2+y^2}} dx\, dy$

   b) Find the volume bounded by $x^2 + y^2 = 4$ and the planes $y + z = 3$ and $z = 0$

MODULE III

10. a) Solve the differential equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = x^2e^{3x}$

    b) Using convolution theorem, find $L^{-1}\left[\frac{s}{(s^2+a^2)^2}\right]$

11. a) Solve the differential equations $\frac{dx}{dt} - 3x - 6y = t^2$; $\frac{dy}{dt} + \frac{dx}{dt} - 3y = e^t$

    b) Solve the differential equation using Laplace transform

$$y'' - 3y' + 2y = 4t + e^{3t} \text{ when } y(0) = 1, y'(0) = -1$$

MODULE IV

12. a) Test the consistency and solve the system of equations

$$3x + y + 2z = 3 ; 2x - 3y - z = -3 ; \ x + 2y + z = 4$$

    b) Using Cayley-Hamilton theorem, find the inverse of A = $\begin{bmatrix} 1 & 0 & -2 \\ 2 & 2 & 4 \\ 0 & 0 & 2 \end{bmatrix}$

13. a) Find the eigen values and eigen vectors of the matrix

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$

    b) Express the quadratic form $q = x^2 + 3y^2 + 3z^2 - 2yz$ as sum of squares.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
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13.101 ENGINEERING MATHEMATICS - I (ABCEFHMNPRSTU)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

PART-A

*Answer **all** questions. **Each** question carries **4** marks.*

1. Evaluate $\lim_{x\to 0}(1+tanx)^{cotx}$
2. Change the order of integration and hence evaluate $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y}\,dy\,dx$
3. Find the Laplace Transform of $t^2 e^t sin\,t$
4. Show that the vectors $(1,2,-1,3)$, $(2,-1,\ 3,2)$ and $(-1,\ 8,-9,\ 5)$ are linearly independent. Find the relation between them.
5. Show that the quadratic form ${x_1}^2 + 2{x_2}^2 + 3{x_3}^2 + 2x_2x_3 + 2x_1x_2 - 2x_3x_1$ is indefinite

PART – B

*Answer **one full** question from **each** module. Each question carries **20** marks.*

MODULE I

6. a) If $y = (sin^{-1}x)^2$, show that $(1+x^2)y_{n+2} + (2n+1)xy_{n+1} + n^2y_n = 0$

   b) If $u = x^2 + 2xy$; $v = y^2 - x^2$ and $= rcos\theta$, $y = rsin\theta$, find $\frac{\partial(u,v)}{\partial(r,\theta)}$

7. a) Show that the circle of curvature of the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ at the point $(a/4,\ a/4)$ is $\left(x - \frac{3a}{4}\right)^2 + \left(y - \frac{3a}{4}\right)^2 = \frac{a^2}{2}$

   b) Show that of all rectangular parallelepiped with given volume, the cube has the least surface area.

MODULE II

8. a) By transforming to polar coordinates evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+x^2)}\,dx\,dy$

   b) Find the volume bounded by the co-ordinate planes and the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$

9. a) Evaluate $\int\int xy\,dx\,dy$ taken over the positive quadrant of the circle $x^2 + y^2 = a^2$

   b) Find the area bounded by the parabolas $3y^2 = 25x \ and \ 5x^2 = 9y$

MODULE III

10. a) Find the inverse Laplace transform of (a) $\frac{s+1}{(s^2+2s+2)^2}$ (b) $\frac{s+2}{s^2(s+3)}$

    b) Solve the equation $\frac{d^2y}{dx^2} + 4y = sec2x$ using the method of variation of parameters.

11. a) Using convolution theorem find the inverse Laplace transform of $\frac{s^2}{(s^2+a^2)(s^2+b^2)}$

    b) Solve the equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = sin(logx^2)$

MODULE IV

12. a) Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & -1 & 3 \\ 3 & -1 & 2 & 1 \\ 2 & -2 & 3 & 2 \\ 1 & -1 & 1 & -1 \end{bmatrix}$

    b) Reduce the quadratic form $q = 3x^2 + 5y^2 + 3z^2 - 2zx - 2yz - 2xy$ to the canonical form. Find the rank, index and signature.

13. a) Reduce the matrix $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ to the diagonal form.

    b) Show that the equations $x + 2y - z = 3$; $3x - y + 2z = 1$; $2x - 2y + 3z = 2$; $x - y + z = -1$ are consistent and find the solution.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
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13.102 ENGINEERING PHYSICS (ABCEFHMNPRSTU)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

Part A

*Answer **all** questions. Each question carries **2** marks.*

1. Explain the phenomenon of resonance. Give two examples.
2. State and explain Poynting's theorem.
3. Define the terms space lattice and unit cell.
4. State the postulates of special theory of relativity.
5. Describe interference filters.
6. Light of wavelength 5893Å is incident normally on a plane transmission grating having 6000 lines/cm. Calculate the angle at which the first order principal maximum is obtained.
7. Explain the phenomenon of double refraction.
8. What are macrostates and microstates?
9. Explain the physical significance of wavefunction.
10. Explain the terms population inversion and stimulated emission in laser.

Part B

*Answer **one full** question from each module. Each question carries **20** marks.*

MODULE I

11. (a) Obtain the differential equation for damped harmonic oscillator. Solve the differential equation and discuss the three cases of damping. (10 Marks)

    (b) Derive one dimensional wave equation. (10 Marks)

12. (a) From the basic laws of electricity and magnetism derive Maxwell's electromagnetic equations. (10 Marks)

    (b) Prove that velocity of electromagnetic waves in free space is equal to the velocity of light. (10 Marks)

MODULE II

13. (a) Define the terms co ordination number and packing factor for cubic crystals. Obtain their values for sc, bcc and fcc lattices. (10 Marks)

    (b) What are Miller indices? Explain how Miller indices of a crystal plane can be determined. (5 Marks)

    (c) Molybdenum has bcc structure. Its density is 10.2×10^3 kg/m^3 and its atomic weight is 95.94. Determine the radius of Molybdenum atom. (5 Marks)

14. (a) Explain the phenomeneon of time dilation. (6 marks)

    (b) Derive Einstein's mass energy relation. (8 marks)

    (c) Describe Meissner effect in superconductivity. (6 marks)

MODULE III

15. (a) Describe Newton' rings experimental set up. Obtain the expression for radius of the n^{th} dark ring. (10 Marks)

    (b) Define resolving power of an optical instrument. Deduce the expression for resolving power of a microscope. (5 Marks)

    (c) Explain piezoelectric generator. (5 Marks)

16. (a) Describe with theory production and detection of elliptically and circularly polarized lights. (10 Marks)

    (b) Explain Kerr effect. (5 Marks)

    (c) Describe briefly the detection of ultrasonic waves. (5 Marks)

MODULE IV

17. (a) Write down Schrodinger equation for particle in a box. Solve it and obtain energy eigen values and energy eigen functions. (10 Marks)

    (b) State and explain uncertainty principle. Obtain the uncertainty in frequency of light emitted by an atom. (5 Marks)

    (c) Describe how a hologram can be recorded. (5 Marks)

18. (a) Compare Maxwell- Boltzmann, Bose- Einstein and Fermi- Dirac statistics. (10 Marks)

    (b) Describe the construction and working of Ruby laser. (10 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
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13.102 ENGINEERING PHYSICS (ABCEFHMNPRSTU)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

Part A

*Answer **all** questions. Each question carries **2** marks.*

1. What is resonance? Give two examples.
2. Compare conduction current and displacement current.
3. Define space lattice and unit cell.
4. Explain length contraction.
5. What are non reflecting films?
6. What is Rayleigh's criterion for geometric resolution?
7. Calculate the thickness of a quarter wave plate for light of wavelength 5896A°. The refractive indices for ordinary and extraordinary rays being 1.54 and 1.55 respectively.
8. Explain uncertainty principle.
9. What are bosons and fermions?
10. Describe the recording of a hologram.

Part B

*Answer **one full** question from each module. Each question carries **20** marks.*

MODULE I

11. (a) Frame and solve the differential equation for an SHM. (7 marks)

    (b) Derive one dimensional wave equation. (9 marks)

    (c) A wave is represented by

    $$\varphi = 3.0 \times 10^{-3} \cos\ (8.4 \times 10^{13} t + 2.8 \times 10^{5}\, z)\ Vm^{-1}$$

    Compute the (i) amplitude (ii) frequency (iii) wavelength and (iv) wave velocity (z in metre and t in second). (4 marks)

12. (a) Show that velocity of an EM wave in free space is $1/\sqrt{\mu_\circ \varepsilon_\circ}$ (10 Marks)

    (b) Assuming plane wave solutions prove that $E_z = 0$, $H_z = 0$ for an EM wave propagating along the z-direction. (10 Marks)

MODULE II

13. (a) Explain Meissner effect. (6 marks)
    (b) Distinguish between Type I and Type II superconductors. (10 Marks)
    (c) Obtain the Miller indices of a plane which intercepts at a, $b/2$, 3c in a simple cubic unit cell. (4 marks)

14. (a) What are Miller indices? Obtain a relation between interplanar spacing and Miller indices. (8 marks)
    (b) Derive $E = mc^2$. (8 marks)
    (c) Calculate the velocity at which the mass of a body becomes twice its rest mass. (4 marks)

MODULE III

15. (a) Describe piezoelectric method for producing ultrasonic waves. (6 marks)
    (b) Discuss Fraunhofer diffraction at a single slit. (10 Marks)
    (c) Light of wavelength 656nm falls normally on a grating 20mm wide. The first order is 18° from the normal. What is the total number of lines in the grating? (4 marks)

16. (a) Describe an experiment to measure the diameter of a thin wire using an air wedge arrangement. (10 Marks)
    (b) Describe the construction and working of a Nicol prism. (10 Marks)

MODULE IV

17. (a) Deduce Schrodinger's time dependent wave equation from the operators of position and momentum. (7 marks)
    (b) Explain the principle and working of Ruby laser. (10 Marks)
    (c) What are the advantages of gas lasers over solid state lasers. (3 marks)

18. (a) Distinguish between spontaneous emission and stimulated emission. (5 Marks)
    (b) Deduce Planck's law from BE statistics. (10 Marks)
    (c) Find the Fermi energy in Chromium assuming that each Chromium atom contributes one free electron to the Fermi gas. The density of Chromium is 7.2 $\times$ 10^3 kg/m^3 and the atomic mass is 52 amu. (5 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
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13.103 ENGINEERING CHEMISTRY (ABCEFHMNPRSTU)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

PART-A

*Answer **all** questions. **Each** question carries **2** marks.*

1. Distinguish between addition and condensation polymerization.
2. Write short note on vulcanization of rubber.
3. What are BOD and COD?
4. Mention the important units of hardness.
5. What is scale? Give its two disadvantages.
6. Outline the functions of drying oils in paint.
7. What is sacrificial anode protection?
8. Illustrate the formation of Helmholtz electrical double layer.
9. What are carbon nanotubes?
10. Explain briefly the classification of refractories with example.

PART-B

Answer any one full question from each module.
*Each question carries **20** marks. (20x4=80)*

MODULE I

11. (a) Explain the different types of moulding techniques.
    (b) Describe the principle, instrumentation and applications of gas chromatography?

OR

12. (a) Explain the thermogravimetric analysis and its applications with an example.
    (b) Explain the principle instrumentation and applications of IR spectrum.

MODULE II

13. (a) Explain the important factors affecting the rate corrosion.
    (b) Explain the following
        (i) Anodising (ii) Galvanising (ii) Pilling and Bedworth rule.

OR

14. (a) How will you determine the PH of a solution, using Glass electrode. Find out the PH of a solution in a hydrogen electrode half cell, which is coupled with a saturated calomel electrode. The emf of the combined cell was determined to be 0.523V at 250C.

(b) Construction, working and applications of (i) Lithium ion cell. (ii) H2-O2 fuel cell.

MODULE III

15. (a) What are the sources of air pollution and how it can be controlled.

(b) Briefly describe the estimation of hardness of water by EDTA method.

OR

16. (a) Explain the ion exchange method for water softening.

(b) Explain the different steps involved in municipal water treatment.

MODULE IV

17, (a). Distinguish between LCV and HCV. How will you determine the calorific value of solid fuels by Bomb calorimeter?

(b) Give the various steps involved in the manufacture of Portland cement.

OR

18. (a) (i) What is octane number and cetane number (ii) Explain setting and hardening of cement.

(b) What are refractories? Explain what refractoriness is. Describe the manufacture of silica bricks.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
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13.103 ENGINEERING CHEMISTRY (ABCEFHMNPRSTU)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

PART-A

*Answer **all** questions. **Each** question carries **2** marks.*

1. Write short note on vulcanization of rubber
2. Describe the method of extrusion moulding.
3. What is aerobic and anaerobic oxidation?
4. Give the principle of reverse osmosis
5. What is boiler corrosion? Give causes.
6. What is anodising?
7. What are corrosion inhibitors?
8. Distinguish between primary and secondary cells.
9. What is biodiesel?
10. Outline the refractoriness of a refractory material.

PART-B

Answer any one full question from each module.
*Each question carries **20** marks. (20x4=80)*

MODULE I

11. (a) Briefly describe the important moulding constituents of plastics with functions and examples.

    (b) Explain the principle instrumentation and applications of nmr spectrum.

OR

12. (a) Explain the differential thermal analysis and its applications with an example

    (b) Explain the principle, instrumentation and applications of HPLC

MODULE II

13. (a) Derive Nernst equation. Find out the PH of a solution in a hydrogen electrode half cell, which is coupled with a saturated calomel electrode. The emf of the combined cell was determined to be 0.223V at 250C.

(b) Explain the construction, working and applications of (i) H_2 - O_2 fuel cell. (ii) Ag Concentration cell.

OR

14. (a) What are paints? Mention the important constituents, their functions with examples.

(b) Write notes on (i) Cathodic protection (ii) Mechanism of wet corrosion.

MODULE III

15. (a) Briefly describe the estimation of hardness of water by EDTA method.

(b) Explain the zeolite process for water softening.

OR

16. (a) Explain the different steps involved in sewage treatment

(b) Write note on (i) Reverse osmosis (ii) Break point of chlorination.

MODULE IV

17. (a) Distinguish between LCV and HCV.

(b) How will you determine the calorific value of coal using Bomb calorimeter? Explain briefly the proximate analysis of coal.

OR

18. (a) Explain the manufacture of Portland cement.

(b) What are nanomaterials? Explain how nanomaterials are classified? Describe the manufacture of nanomaterials by Laser ablation method.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.104 ENGINEERING GRAPHICS (ABCEFHMNPRSTU)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

Instructions: 1) Choose suitable scale and dimension the drawing properly.

2) Retain all construction lines.

*3) Answer **one** full question each from MODULE I and II and **two** full questions each from MODULE III and IV*

MODULE I

(*Answer **one** full question. Each question carries 16 marks*)

1. The co-ordinate position of the vertex of a parabola is at (0, 0). The co-ordinate positions of the end points of the double ordinate of the parabola are (30, 50) and (30, -50). Draw the curve and also a tangent and normal at any point on the curve.

2. Draw a cycloid for one convolution for a generating circle of diameter 60mm. The initial position of the point on the circle is at the left end of the center of the circle. Also draw a tangent and normal at any one point on the curve.

MODULE II

(*Answer **one** full question. Each question carries 16 marks*)

3. A line 80mm long has the end A in the HP and the other end B in the VP. The line makes 45^o to HP and 20^o to VP. Draw the projections if the line is in the second quadrant. Also mark the traces of the line.

4. Draw the projections of the frustum of a pentagonal pyramid having 40mm base edge, 20mm top edge and 60mm height resting with its base in HP and a side of the base perpendicular to VP. Obtain an auxiliary view of the solid on an AIP showing the true length of a slant edge on it.

MODULE III

(*Answer **any two** full questions. Each question carries 17 marks*)

5. An octahedron of side 45mm has one of its faces in HP and an edge of that face inclined at 45^{o} to VP. Draw its projections.

6. A hexagonal pyramid, base edge 30mm and height 60mm is resting on the ground on one of its triangular faces. It is cut by a plane perpendicular to VP, passing through an edge of the base and bisecting the axis of the pyramid. Draw the projections showing the true shape of the section. Also find the inclination of the cutting plane with the HP.

7. A hexagonal prism , base edge 30mm and height 60mm is resting with its base on HP with one of the base edge parallel to VP. A square hole of 30mm side is drilled through the prism in such a way that the axis of the hole is perpendicular to VP and intersects the axis of the solid. The sides of the square hole are equally inclined to HP. Draw the development of the lateral surfaces of the prism.

MODULE IV

(*Answer **any two** full questions. Each question carries 17 marks*)

8. The frustum of a square pyramid has side of base 70mm, top edge 40mm and height 60mm. A cone of base diameter 50mm and height 60mm is paced centrally on top of the frustum. Draw the isometric projection of the combination.

9. A vertical cone of 84 mm base diameter and axis 100mm is completely penetrated by a horizontal cylinder of diameter 50mm and length 100mm. If the axis of the cylinder intersects the axis of the cone at a height of 30mm from the base and is parallel to VP, draw the projections of the solid showing the curves of intersection.

10. A hexagonal pyramid of side of base 30mm and height 60mm rests with an edge of the base touching the PP. The station point is on the central plane passing through the apex 90mm in front of the picture plane and 80mm above the ground. Draw the perspective projection of the solid.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.104 ENGINEERING GRAPHICS (ABCEFHMNPRSTU)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

Instructions: 1) Choose suitable scale and dimension the drawing properly.

2) Retain all construction lines.

*3) Answer **one** full question each from MODULE I and II and **two** full questions each from MODULE III and IV*

MODULE I

(*Answer **one** full question. Each question carries 16 marks*)

1. A jet of water is discharged from ground level at an angle of 50^o with the horizontal and reaches a maximum height of 6m. Trace the path of the jet and name the curve. Also show the direction of the velocity of the jet at a height of 3m above the ground.

2. Draw a clockwise logarithmic spiral for one convolution. The ratio of successive radii is 8:7. The final radius is 120mm and vectorial angle is 30^o. Also draw a tangent and normal at any one point on the curve.

MODULE II

(*Answer **one** full question. Each question carries 16 marks*)

3. A straight line has its vertical trace 40mm above HP and horizontal trace 50mm in front of VP. The projectors through the traces are 100mm apart. If the point A is 10mm above HP and point B is 15mm in front of VP, draw the projections of the line AB. Determine the true length and true inclinations of the line with the reference planes.

4. A rectangular prism of base 25x35mm and length 60mm rests with its base on the ground and a long edge of the base inclined at 30^o to VP. Draw its projections and also obtain an auxiliary plan on a plane inclined at angle of 40^o.

MODULE III

(*Answer **any two** full questions. Each question carries 17 marks*)

5. A pentagonal pyramid having side of base 30mm and height 80mm is resting with one of its triangular faces on the ground. The base edge of that face is inclined at 30^o to VP. Draw the projections of the pyramid.

6. .A cube of 40mm is cut by a section plane such that the true shape is a trapezium having one of its parallel sides of maximum possible length and the other parallel side having half the maximum possible length. Draw the projections showing the true shape of the section. Also find the inclination of the cutting plane with HP

7. A lamp shade is formed by cutting a cone of base diameter 140mm and height 180mm by a horizontal plane at a distance of 70mm from the apex and another plane inclined at 30^o to HP and passing through one extremity of the base. Draw the development of the lamp shade.

MODULE IV

(*Answer **any two** full questions. Each question carries 17 marks*)

8. A sphere of diameter 40mm is placed centrally on top of a frustum of a hexagonal pyramid of 25mm side of base, 15mm side at top and axis 40mm long. Draw the isometric projection of the combination.

9. .A horizontal cylinder of diameter 40mm penetrates a vertical cylinder of diameter 60mm. The axis of the piercing cylinder is parallel to both HP and VP and is offset by a distance of 10mm from the axis of the vertical cylinder. Draw the curves of intersection.

10. .A cube of side 25mm is placed vertically with one of its edges on the PP and the top square end face touching an auxiliary ground plane at a height of 45mm above the horizon plane. The vertical edge formed by the two adjacent rectangular faces which are inclined at 45^o to the PP touches the PP. Draw the perspective of the cube if the station point is 70mm in front of PP and lies in a central plane which is 30mm to the right side of the center of the cube.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.105 ENGINEERING MECHANICS (ABCEFHMNPRSTU)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

PART-A

*Answer **all** questions. **Each** question carries **4** marks.*

1. Explain (i) principle of transmissibility of forces; and (ii) Varignon's theorem'
2. Using Pappus - Gouldinus theorem, determine the centroid of a quarter circle of radius 'R'.
3. Find the horizontal force to be applied to a ladder (of length 3m and weight 550N) leaning against a vertical wall to avoid slipping, if inclination of the ladder with the horizontal floor is 50°.coefficient of friction for all contact surfaces = 0.23.
4. Define instantaneous centre of zero velocity? State the properties of instantaneous centre.
5. A person travelling on a train (which moves at 80 kmph due east) feels the wind blowing from north-east though the actual direction of wind is towards south. Find the actual velocity of wind.

PART-B

*Answer **one full** question from **each** module. Each question carries **20** marks.*

MODULE I

6. State the conditions of equilibrium of a coplanar concurrent force system. Two cylinders X and y (of diameter 200mm and 360mm respectively) is in equilibrium as shown in Fig. 1. The weights of cylinders are respectively120N and 360N. Determine the reactions at all the contact surfaces.

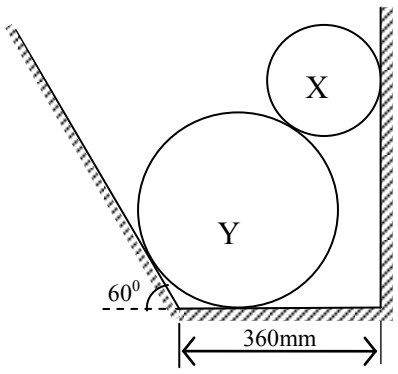


Fig. 1.

7. A system of forces and moments acting in space are:

   $\overrightarrow{F_1}$ = 3i + 5j - 6k acting at (2, 1, -3); $\overrightarrow{F_2}$ = 5i - 4j +3k acting at(l, 4, 2) ; and

   $\overrightarrow{M}$ = 20i - 35j + 60k

   Find the resultant force vector and its magnitude. Also determine the moment of the system about the origin.

MODULE II

8. Starting from the fundamentals, determine the moment of inertia of the shaded area shown in Fig.2 about its centroidal XX and YY axes.

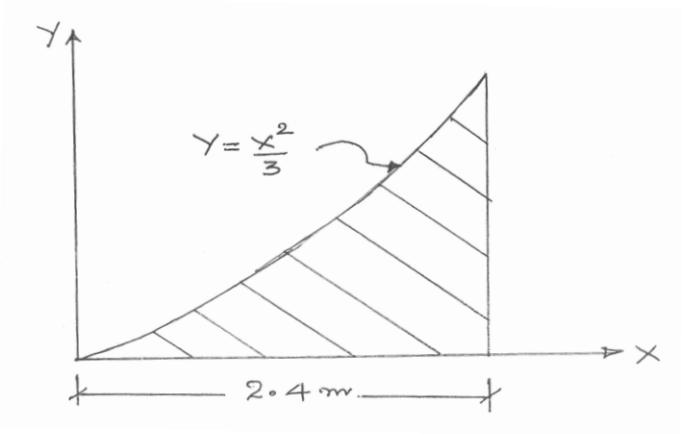


Fig.2

9. Determine the support reactions for the loaded beams shown in Fig.3.

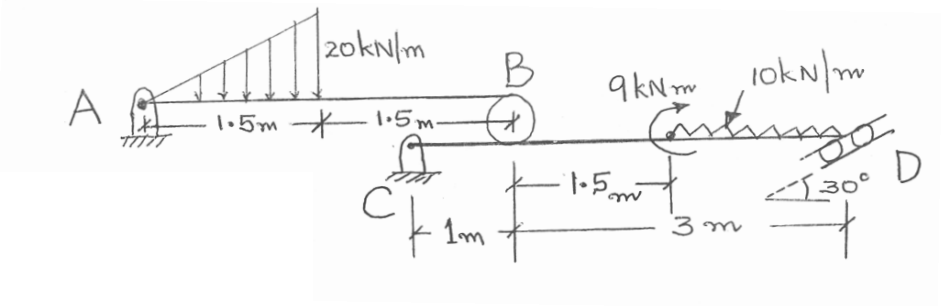


Fig.3

MODULE III

10. a) A roller having radius of 50mm rolls, without any slipping, between two horizontal belts moving in opposite directions with velocities of l2m/sec and 18m/sec. Determine the velocity at the centre of the roller. (10marks)

    b) A block (W = 2000N) placed on a 10° inclined plane (coefficient of friction between the plane and the block = 0.2) is pulled parallel to the plane using a rope passing over a frictionless pulley, by attaching a weight of 800N to the other end of the rope. Using D'Alembert's principle, determine the tension in the rope. Also find the distance moved by the block in 3sec. (l0marks)

11. a) A ball of mass 5kg is dropped on to the top of a spring from a height of 100mm. Find the compression of the spring, if its stiffness is 0.5N/mm. (l0marks)

    b) A ball moving at l0m/sec. strikes another identical ball moving at 8m/sec such that, at the instant of impact, their velocities are inclined at 30° and 45° respectively to the line joining their centres. Find their velocities after impact, if the impact is perfectly elastic. (l0 marks)

MODULE IV

12. Derive an expression for the maximum speed with respect to skidding of a vehicle travelling on a banked road, in terms of the banking angle (θ), radius of the horizontal curve (R) and friction angle (Φ) between the tyre and road. (20marks)

13. a) Frequency of free vibrations of a weight 'W' attached to a spring is l5 cycles/sec. If the frequency becomes 10 cycles/sec, when an extra weight of 25N is coupled with 'W', determine the stiffness of the spring. (l0 marks)

    b) Consider a solid sphere, initially at rest rolling down an inclined plane of slope 12°. What would be its velocity once it has rolled down for a distance of 10m? (l0marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.105 ENGINEERING MECHANICS (ABCEFHMNPRSTU)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

PART-A

*Answer **all** questions. **Each** question carries **4** marks.*

1. What is meant by a couple? State the properties of couple.
2. State Pappus-Gouldinus theorem used for determination of volume of a solid. Illustrate with an example.
3. Explain the principle of virtual work.
4. Explain D'Alembert's principle in curvilinear motion.
5. Define simple harmonic motion. Write down the equation for time period (T) of angular free vibrations of a simple pendulum.

(4marks x 5 = 20marks)

PART B

*Answer **one full** question from **each** module. Each question carries **20** marks.*

MODULE I

6. Define the terms composition, resolution, and free body diagram. Compute the magnitude, direction and location of the resultant for the force system shown in Fig. l.

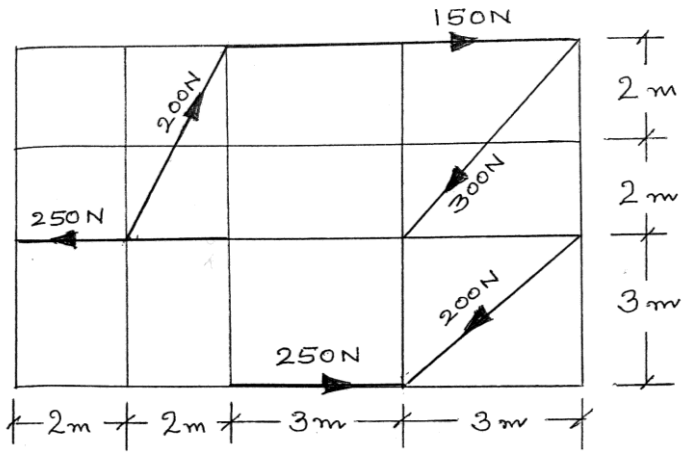


Fig. 1.

7. Five forces are acting along the edges of a triangular prism as shown in Fig.2. Reduce this force system to a force-couple system at the origin.

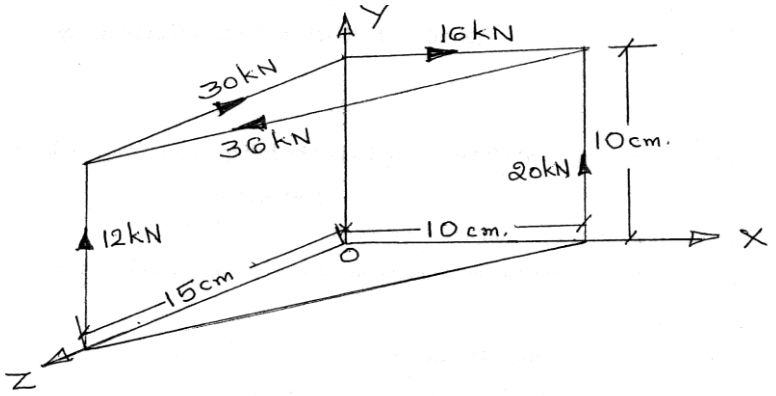


Fig. 2.

MODULE II

8. Locate the centroid of the composite area shown in Fig.3. Also determine the moment of inertia of the area about its centroidal axes.

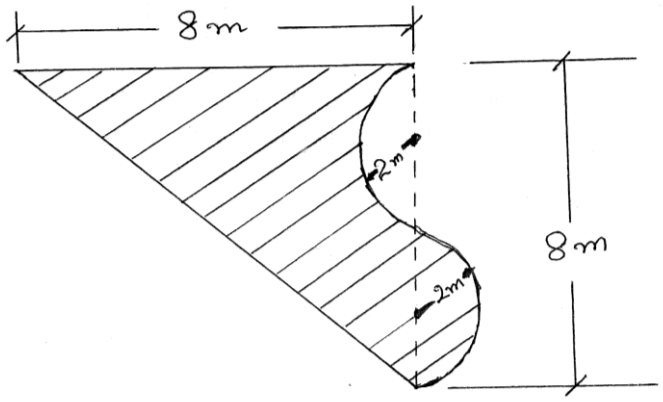


Fig. 3.

9. Determine the support reactions for the loaded beams shown in Fig.4.

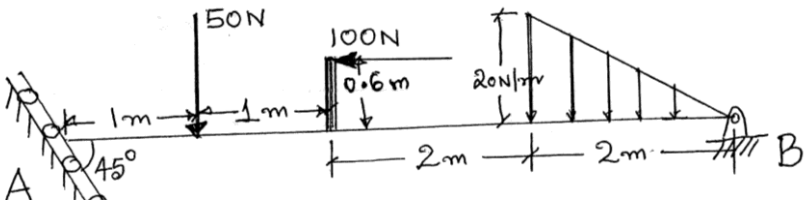


Fig. 4.

MODULE III

10. Define instantaneous centre and centrode. For the slider crank mechanism shown in Fig.5, determine the speed of piston using the principle of instantaneous centre. Also find the velocity of the mid-point of the connecting rod. The crank OA has an angular speed (ω) = l200 rpm. θ = :30° .

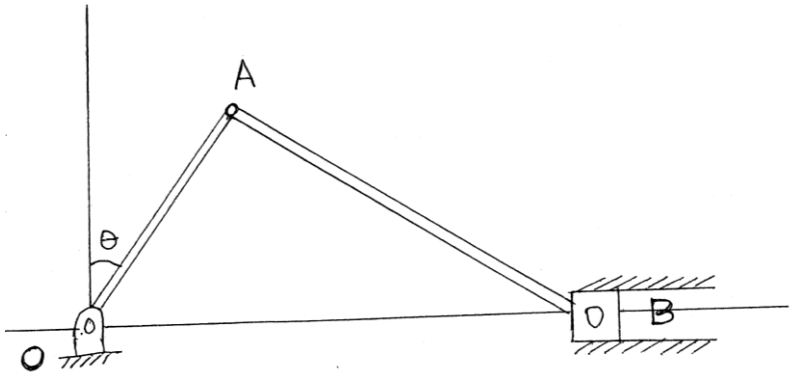


Fig. 5.

11. a) A ball is dropped from a height of 2m on to a horizontal floor. Derive an expression for the total distance described by the ball before it finishes rebounding, in terms of the coefficient of restitution between the ball and the ground. (10marks)

    b) A man weighing 610N is standing on a weighing scale placed on the floor of an elevator (of weight 9.2kN) which is moving vertically downwards at constant acceleration of 0.9m/sec^2. Determine the tension in the elevator cable and reading on the weighing scale. (10marks)

MODULE IV

12. Explain the concept of relative velocity. At 6am, two ships P & Q are 100km apart, Q being south of P. Ship Q is steaming due east at 20 kmph, while ship P is steaming on a south-east course at 40 kmph. The two ships can exchange signals as long as they are within 50km distance. Find (i) at what time will the ships would start exchanging signals, and (ii) how long the exchange of signals will continue?

13. a) A block weighing 6000N is raised by a rope, one end of which is wrapped around a drum (diameter = 1.1m; mass = l35kg; radius of gyration = 0.45m) rotated by an

electric motor which exerts a constant torque of 5450Nm. Determine the acceleration of the block and the tension in the rope. (10 Marks)

b) A vehicle of mass 1200kg is to turn around a horizontal circular curve of radius 100m with a velocity of 30kmph. Height of centre of gravity of the vehicle is lm above road surface and distance between the centres of wheels is 1.5m.

Find (i) reactions on the wheels, and (ii) maximum speed the vehicle can negotiate without fear of overturning. (10marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.106 BASIC CIVIL ENGINEERING (ABEFHMNPRSTU)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

PART A

(Answer all questions. Each question carries 4 marks)

1. Explain the working principle of Optical square.
2. Write short notes on 'Bench marks'.
3. How do piles support loads?
4. What are the different types of reinforcing steel available in the market?
5. Write a note on water quality standards.

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

6. a) Explain the principles of levelling. (5 Marks)

   b) Explain the temporary adjustments of dumpy level. (15 Marks)

OR

7. a) Define contour. What do you understand by contour interval and on what factors does it depend? (6 Marks)

   b) The following perpendicular offsets were taken at 10 m intervals from a survey line to an irregular boundary line are 3.82, 4.37, 6.82, 5.26, 7.59, 8.90, 9.52, 8.42, 6.43 and 7.50 m. Calculate the area in square metres enclosed between the survey line, the irregular boundary line and the first and last offset by the application of the

   i) Trapezoidal rule and ii) Simpson's rule. (14 Marks)

MODULE II

8. a) Explain the different components of a building with sketch. (10 Marks)

   b) Describe the different types of doors used in buildings. (10 Marks)

OR

9. a) Write notes on different materials used for making partitions (5 Marks)

   b) What are the different types of sloping roof? Explain with sketches. (15 Marks)

MODULE III

10. a) What are the different ingredients of concrete? List the functions of each of the ingredients (10 Marks)

    b) What are the advantages of RCC over plain concrete? (10 Marks)

OR

11. a) Write short notes on compressive strength of concrete (6 Marks)

    b) What are the different methods adopted for mixing of concrete? (7 Marks)

    c) Describe the properties of mild steel and HYSD steel (7 Marks)

MODULE IV

12. Describe in detail about the concept of sustainable buildings (20 Marks)

OR

13. What are the different types of environmental pollution? How does it affect the nature? (20 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.106 BASIC CIVIL ENGINEERING (ABEFHMNPRSTU)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

PART A

(Answer all questions. Each question carries 4 marks)

1. What are the principles of Surveying?
2. What are the uses of contour maps?
3. Define a flat roof and mention its advantages and disadvantages.
4. Write short note on water cement ratio as applied to concrete.
5. What are the different characteristics of water pollution

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

6. a) What is meant by ranging out a survey line? (3 Marks)

   b) Explain in detail reciprocal levelling (5 Marks)

   b) The following consecutive readings were taken with a dumpy level

   1.435, 2.555, 2.720, 2.965, 3.155, 2.625, 1.620, 1.895, 2.420, 2.710, 1.950.

   The instrument was shifted after the 4^{th}, 7^{th} and 9^{th} readings. RL of 1^{st} point was 100m. Rule out a page of a level field book and find the reduced levels of all other stations. Apply the arithmetic check. (12 Marks)

OR

7. a) What is Simpson's rule in computation of areas? (4 Marks)

   b) The following offsets were taken from a chain line to hedge:

Distance in metres	0	20	40	60	80	100	120
Offsets in metres	9.5	10.7	13.5	10.5	15.5	12	8.5

   Compute the area included between the chain line, hedge and the end offsets by Simpson's rule. (10 Marks)

   c) Write short notes on Total station. (6 Marks)

MODULE II

8. a) What are the different types of stone masonry? Explain with sketches. (10 Marks)

   b) Explain the requirements of a good plaster and the types of mortar used for plastering (6 Marks)

   c) State the characteristics of English bond. (4 Marks)

OR

9. a) Explain the factors to be considered while selecting a site for a building. (10 Marks)

   b) Explain the different types of shallow foundation with sketches. (10 Marks)

MODULE III

10. a) Enumerate the different tests on cement with IS specifications. (10 Marks)

    b) What are the desirable qualities of fine and coarse aggregate used for making concrete? (10 Marks)

OR

11. a) Explain the different stages in the preparation of concrete. (10 Marks)

    b) What is meant by workability of concrete? Explain the slump test of concrete. (10 Marks)

MODULE IV

12. What are the different types of air pollution? Mention their sources and the effects on the environment (20 Marks)

OR

13. Discuss in detail the global environmental issues (20 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.106 BULDING TECHNOLOGY (C)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

PART A

(Answer all questions. Each question carries 4 marks)

1) What is meant by dressing of stones?

2) Explain well foundations.

3) Differentiate between English bond and Flemish bond.

4) Write a short note on termite proofing.

5) Explain the terms i) corbel ii) cornice iii) coping.

(5x4 =20 Marks)

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

6) Briefly explain different tests for brick as per IS specifications. List the IS specifications of first quality bricks.

OR

7) What is seasoning of timber? Explain any three methods of seasoning of timber.

MODULE II

8) Explain with a neat sketch the plate load test for determining the bearing capacity of soil.

OR

9) a) Explain the factors to be considered while selecting a site for a building.

b) Explain raft foundations and its applications.

MODULE III

10) a) Sketch and explain different types of rubble masonry.

b) Explain various types of arches

OR

11) Explain with neat sketches various types of shoring.

MODULE IV

12) a) Explain with neat sketches various types of stairs.

b) What are the various types of flooring materials used for building construction?

OR

13) What is plastering? What are the advantages of plastering? Explain the method of plastering a new brick wall.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.106 BULDING TECHNOLOGY (C)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

PART A

(Answer all questions. Each question carries 4 marks)

1) List various methods of quarrying of building stones.
2) Discuss various methods of improving bearing capacity of soil.
3) Distinguish between arches and lintels.
4) Write a short note on damp proof course.
5) What are geotextiles?

(5x4 =20 Marks)

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

6) a). What are the types and functions of reinforcing steel in concrete? Explain the various market forms of structural steel.

   b) Discuss the application of aluminium in construction.

OR

7) What is preservation of timber? Describe different methods for preserving timber.

MODULE II

8) Explain with neat sketches various types of shallow foundations.

OR

9) Explain various methods for timbering of foundation trenches.

MODULE III

10) Explain with neat sketches various types of scaffolding.

OR

11) a) Explain the salient features of English bond. Sketch the alternate courses of 1½ brickwork in English bond.

b) Explain the advantages and disadvantages of cavity walls.

MODULE IV

12) a) What are the various roof covering materials used in building construction. List the advantages of each material.

b) Differentiate i) post and style ii) rail and head with respect to a panelled door. What are the various types of flooring materials used for building construction?

OR

13) What is painting? Explain the process of painting i) new woodwork ii) cement plastered surface.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.107 BASIC MECHANICAL ENGINEERING (ACEFRT)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

PART A

(Answer all questions. Each question carries 2 marks)

1. Define coefficient of performance. Write down the equations of COP of a refrigerator and a heat pump
2. What is a stream line? Write down the equations of components of velocity of a two-dimensional flow in terms of stream function.
3. Sketch T-S diagram of Carnot cycle and indicate name of each process.
4. Define air standard efficiency. Write down the equation for air standard efficiency of Otto cycle.
5. Explain MPFI engines
6. Define rotodynamic fluid machines. Give an example.
7. Draw the P-h diagram of a standard vapor compression refrigeration system.
8. Name the materials consumed and produced in a thermal nuclear reactor.
9. Define machining. Give four examples.
10. Differentiate between casting and molding.

(2x10=20 Marks)

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) What are the limitations of first law of thermodynamics and state how second law can overcome these. (10 marks)

    b) Water enters a conical pipe of length, inlet diameter and exit diameter 30 cm, 2.5 cm and 5 cm respectively. The inlet velocity of flow is 3 m/s. The exit end of the pipe is elevated such that its axis makes 30^o with the horizontal. Calculate the pressure head difference between the inlet and the exit. Density of water is 1000 kg/m^3.

    (10 marks)

OR

12. a) Derive an expression for heat transfer in a polytropic process. (10 marks)

b) Write down the steady flow energy equation showing the meaning of all notations used. (10 marks)

MODULE II

13. a) Derive the equation for the efficiency of Diesel cycle in terms of cutoff ratio and compression ratio and hence show that the efficiency of the Diesel cycle is always lower than efficiency of the Otto cycle for the same compression ratio. (10 marks)

b) In an air standard Otto cycle, a heat addition of 2800 kJ/kg of air, a compression ratio of 8, and pressure and temperature at the beginning of compression process of 1 bar, 300K. Determine (i) the maximum pressure and temperature in the cycle (ii) the thermal Efficiency. Take Cp = 1005 kJ./kgK and R = 287 J/kgK for air. (10 marks)

OR

14. a) With the help of a neat sketch, explain the working of a two stroke petrol engine. (10 marks)

b) With the help of a neat sketch, explain the working of Cochran boiler. (10 marks)

MODULE III

15. a) A water tank of capacity 1000 liters kept at a height of 12 m above the sump is required to be filled in 15 minutes. Calculate the power of a centrifugal pump that can be used for this purpose. Take density of water is 1000 kg/m^3. (10 marks)

b) In a gas turbine plant air is compressed from 1 bar and 15°C through a pressure ratio of 6 : 1. It is then heated to 600°C in a combustion chamber and expanded back to 1 bar in a turbine. Calculate the work of turbine, work of compressor and the cycle efficiency. The isentropic efficiencies of the compressor and turbine are 80% and 85% respectively. (10 marks)

OR

16. a) Differentiate between comfort and industrial air conditioning. (10 marks)

b) Describe with the help of a neat sketch, the components and the layout of a thermal power plant. (10 marks)

MODULE IV

17. a) A leather belt of density 1000 kg/m^3, thickness 10 mm is used to transmit 8kW from a pulley 1:5 m diameter, running at 300 rpm. Determine width of the belt required. Take angle of lap is 165^o, coefficient of friction between belt and pulley is 0.25 and allowable stress for leather is 1.5MPa. (10 marks)

b) Explain with a neat sketch the operation of a single plate clutch. (10 marks)

OR

18. a) With the help of a diagram, explain electro discharge machining (10 marks)

b) Describe the process of milling. Explain the applications of milling (10 marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.107 BASIC MECHANICAL ENGINEERING (ACEFRT)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

PART A

(Answer all questions. Each question carries 2 marks)

1. State whether the following systems are open/Closed/isolated system.
   (i) Scooter engine (ii) water turbine (iii) pressure cooker (iv) thermoflask.
2. State the law of thermodynamics used for the temperature measurements.
3. What are the assumptions used in the derivation of Bernoulli's equation?
4. Sketch Diesel cycle on P-V and T-S diagram.
5. Give examples for fire tube boiler and water tube boiler.
6. What is meant by priming?
7. List the applications of gas turbines
8. What are the advantages of gear drive over belt drive?
9. Differentiate between soldering and brazing.
10. What are the advantages of CNC machines? (2x10=20 Marks)

PART B

Answer any one full question from each module. Each question carries **20** marks.

MODULE I

11. a) Define Internal Energy. Show that internal energy is a property of a system (8 Marks)

    b) State and Explain the second law of thermodynamics and show that the two Statements are equivalent (12 Marks)

OR

12. a) Derive the Steady Flow Energy Equation and state the assumptions (10 Marks)

    b) State and explain Pascal's law (5 Marks)

    c) Distinguish between laminar flow and turbulent flow (5 Marks)

MODULE II

13. a) Explain with suitable sketches, the working of a four stroke petrol engine. (10 Marks)

    b) In an air standard Diesel cycle, the pressure at the end of compression is 32 bar and the cut off is 5% of stroke. If the cycle operates on 1 kg of air with an initial pressure of 1 bar and a temperature of 32^0C, determine the compression ratio and thermal efficiency (10 Marks)

OR

14. a) Explain with a neat sketch, the working of a Benson boiler (10 Marks)

    b) Explain the various methods of cooling used in IC engines (10 Marks)

MODULE III

15. a) With the help of a suitable sketch ,explain the working of a reciprocating pump (10 Marks)

    b) Compare open and closed cycle gas turbine plants. (5 Marks)

    c) What are the desirable features of refrigerants? (5 Marks)

OR

16. a) Sketch and explain the working of a hydraulic power plant. (10 Marks)

    b) Explain the working of a vapour compression refrigeration system. (10 Marks)

MODULE IV

17. a) Explain the different types of gear trains (10 Marks)

    b) Describe any two types of welding processes (10 Marks)

OR

18. a) Describe the following production processes:

    (i) Rolling (ii) Grinding (10 Marks)

    b) Explain with a neat sketch electrochemical machining(ECM) and mention its advantages and disadvantages (10 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.107 ENGINEERING THERMODYNAMICS (MNPSU)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

Instructions: Use of approved steam tables and psychrometric chart permitted.

PART A

(Answer all questions. Each question carries 2 marks)

1. State the zeroth law of thermodynamics.
2. Classify the following properties of a system as extensive or intensive: volume, pressure, energy and density.
3. A room is heated by an iron that is left plugged in. Is this a heat or work interaction? Explain by taking the entire room, including the iron, as the system.
4. What are the causes for irreversibility of a process?
5. State any two corollaries of second law of thermodynamics.
6. What is available energy and unavailable energy?
7. What is the difference between saturated vapour and superheated vapour?
8. What is the concept of 'law of corresponding states'?
9. Explain Dalton's law of partial pressures.
10. Define wet bulb temperature and dew point temperature.

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) Derive the expression for work transfer and heat transfer in a polytropic process.

    b) A gas expands in a piston–cylinder assembly from $p_1 = 8$ bar, $V_1 = 0.02$ m^3 to $p_2 = 2$ bar in a process during which the relation between pressure and volume is $pV^{1.2}$ = constant. The mass of the gas is 0.25 kg. If the specific internal energy of the gas decreases by 55 kJ/kg during the process, determine the heat transfer, in kJ. Kinetic and potential energy effects are negligible.

OR

12. a) Derive the steady flow energy equation, stating all the assumptions.

b) Air enters a compressor operating at steady state at a pressure of 1 bar, a temperature of 290 K, and a velocity of 6 m/s through an inlet with an area of 0.1 m^2. At the exit, the pressure is 7 bar, the temperature is 450 K, and the velocity is 2 m/s. Heat transfer from the compressor to its surroundings occurs at a rate of 180 kJ/min. Employing the ideal gas model, calculate the power input to the compressor, in kW.

MODULE II

13. a) State the Kelvin-Plank and Clausius statements of second law of thermodynamics and prove their equivalence.

b) 0.5 kg of air at 1 bar and 47 °C is compressed in a piston-cylinder assembly to 4 bar and 127°C by doing 5 kJ of work when the surrounding temperature is 27°C.

(Cp of air is 1.005 kJ/kgK, R =0.287 kJ/kgK)

Determine: i) the entropy change of air

ii) the entropy change of the surroundings, and

iii) the entropy change of the universe.

OR

14. a) Explain the thermodynamic scale of temperature.

b) A mass of 8 kg of helium undergoes a process from an initial state of 3 m^3/kg and 15°C to a final state of 0.5 m^3/kg and 80°C. Assuming the surroundings to be at 25°C and 100 kPa, determine the increase in the useful work potential of the helium during this process. The gas constant of helium is R = 2.0769 kJ/kg.K, The constant volume specific heat of helium is c_v = 3.1156 kJ/kg.K

Module III

15. a) Sketch and explain the P-V diagram for a pure substance and show the isotherms and constant quality lines on it.

b) A 3.27m^3 tank contains 100 kg of nitrogen at 175 K. Determine the pressure in the tank, using (a) the ideal-gas equation and (b) the van der Waals equation. Compare your results with the actual value of 1505 kPa.

(R = 0.2968 kPa·m3/kg·K, M = 28.013 kg/kmol, T_{cr} = 126.2 K, P_{cr} = 3.39 MPa).

OR

16. a) Explain Joule Thomson effect. What do you mean by inversion temperature?

b) From the first principles derive the Mayer relation, $c_p - c_v = \frac{vT\beta^2}{k}$

where $\beta = \frac{1}{v}\left(\frac{\partial v}{\partial T}\right)_P$ and $k = -\frac{1}{v}\left(\frac{\partial v}{\partial P}\right)_T$

MODULE IV

17. An insulated rigid tank of volume $1m^3$ is divided into two chambers by a partition. One chamber of volume 0.7 m^3 contains helium at 20 bar and 400 K while the other chamber contains Nitrogen at 10 bar and 500 K. The partition is removed and the gases are allowed to mix.

    Calculate: i) the equilibrium temperature and pressure

    ii) the change in entropy of Helium and Nitrogen, and

    iii) the total entropy change

    for Nitrogen: Cp = 1.039 kJ/kg K, Cv = 0.742 kJ/ kg K

    for Helium: Cp = 5.19 kJ/kg K, Cv = 3.12 kJ/ kg K

OR

18. a) Write notes on real gas mixtures.

    b) Sketch and explain a psychrometric chart showing constant volume and constant enthalpy lines. Also explain the cooling, heating, humidifying and dehumidifying processes.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.107 ENGINEERING THERMODYNAMICS (MNPSU)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

Instructions: *Use of approved steam tables and psychrometric chart permitted.*

PART A

(Answer all questions. Each question carries 2 marks)

1. Differentiate between closed system and open system.
2. Derive an expression for work done in an isobaric process.
3. What is a steady flow process?
4. List any two limitations of the first law of thermodynamics.
5. Are all isentropic processes reversible adiabatic? Justify.
6. What is the Fowler-Guggenheim statement of third law of thermodynamics?
7. What is the physical significance of h_{fg}? Can it be obtained from a knowledge of h_f and h_g? How?
8. Define compressibility factor.
9. Explain Gibbs-Dalton's law for gas mixtures.
10. Distinguish specific humidity and relative humidity.

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) Explain the working of a constant volume gas thermometer. What do you understand by an ideal gas temperature scale?

    b) A piston–cylinder device contains 0.8 kg of nitrogen initially at 100 kPa and 27°C. The nitrogen is now compressed slowly in a polytropic process during which $PV^{1.3}$ = constant until the volume is reduced by one-half. Determine the work done and the heat transfer for this process.

OR

12. a) Derive the energy equation for an unsteady flow process, stating all the assumptions.

    b) Air expands through a turbine from 10 bar, 900 K to 1 bar, 500 K. The inlet velocity is small compared to the exit velocity of 100 m/s. The turbine operates at steady state

and develops a power output of 3200 kW. Heat transfer between the turbine and its surroundings and potential energy effects are negligible. Calculate the mass flow rate of air, in kg/s, and the exit area, in m^2.

MODULE II

13. a) State and prove Carnot theorem.

    b) An isolated system of total mass m is formed by mixing two equal masses of the same liquid initially at the temperatures $T_1$and T_2. Eventually, the system attains an equilibrium state. Each mass is incompressible with constant specific heat, c. Show that the amount of entropy produced is

$$\sigma = mc\ ln\left[\frac{T_1 + T_2}{2\sqrt{T_1 T_2}}\right]$$

OR

14. a) Prove that when a system undergoes a process 1-2 the change in entropy

    $\Delta S \geq \int_1^2 \frac{\delta Q}{T}$. Discuss the practical implications of this result.

    b) Two kg of air at 500 kPa, 80°C expands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of surroundings which is at 100 kPa, 5°C. For this process, determine a) the maximum work, b) the change in availability.

MODULE III

15. a) Sketch and explain the p -T diagram for a pure substance.

    b) A closed, rigid container of volume 0.5 m^3 is placed on a hot plate. Initially, the container holds a two-phase mixture of saturated liquid water and saturated water vapour at p_1= 1 bar with a quality of 0.5. After heating, the pressure in the container is p_2 =1.5 bar. Indicate the initial and final states on a T–v diagram, and determine

        (a) the temperature, in °C, at each state.

        (b) the mass of vapour present at each state, in kg

OR

16. a) Derive Maxwell's equations.

    b) The pressure in an automobile tyre depends on the temperature of the air in the tyre. When the air temperature is 25°C, the pressure gauge reads 210 kPa. If the volume of the tyre is 0.025 m^3, determine the pressure rise in the tyre when the air temperature in the tyre rises to 50^oC. Also find the amount of air that must be bled off to restore

the pressure to its original value at this temperature. Take atmospheric pressure as 100 kPa.

MODULE IV

17. A gaseous mixture contains 15% of CO_2, 70% of N_2 and the rest H_2. The composition is in volume percentage. Calculate the molecular weight of the mixture, the characteristic gas constant and the ratio Cp/Cv. The gas at 1 bar and 10^0C occupies a volume of 0.085 m^3. It undergoes a reversible non-flow process during which its volume is reduced to 1/3 of its initial volume. Determine the work done, heat transfer and change in entropy, if the expression for the process is $PV^{1.3}$=constant. Take the Cp value of CO_2, N_2 and H_2 at 10°C as 0.828, 1.038 and 14.235 kJ/kgK, respectively.

OR

18. a) Explain Dalton's law of additive pressures. Does this law hold exactly for ideal-gas mixtures? How about non-ideal gas mixtures?

    b) A room contains air at 1 atm, 26°C, and 70 percent relative humidity. Using the psychrometric chart, determine (a) the specific humidity, (b) the enthalpy (in kJ/kg dry air),(c) the wet-bulb temperature, (d) the dew-point temperature, and (e) the specific volume of the air (in m^3/kg dry air)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.107 PROCESS ENGINEERING CALCULATIONS (H)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

Instructions: *Use of Steam tables and/or Psychrometric Charts are permitted in the examination hall. Missing data, if any, may be assumed suitably.*

PART A

(Answer all questions. Each question carries 2 marks)

1. Convert k = 0.15 Btu/(ft. h. °F) to SI units.
2. An aqueous solution contains 40% by weight $NaNO_3$. Determine the composition in mole%.
3. Air contains approximately 21% Oxygen and 79% nitrogen by volume. Calculate the average molecular weight and composition by wt. of air.
4. Wet leather enters a drier with an initial moisture content of 65% and leaves with 7% moisture. The output is 490 kg/hr. Calculate the input and water evaporated.
5. A gas mixture consisting of 3 moles of nitrogen, 6 moles of hydrogen and 2 moles of ammonia initially is undergoing the following reaction.

   $N_2 + 3\ H_2 \rightarrow 2\ NH_3$

   Derive the expression for the molefractions of the various components in the reaction mixture in terms of the extent of reaction.
6. Explain compressibility factor charts giving its application.
7. Describe the physical significance of Gibb's free energy and Work function.
8. State Raoult's law. How is it used in evaluating T-x,y diagram?
9. List the limitations of the first law of thermodynamics
10. Find out the entropy change when 1 kmol of an ideal gas at 52 ^{0}C and 10 bar is expanded irreversibly to 27 °C and 1 bar.

    The value of C_p may be taken as 29.3 kJ/kmol.K (10 x 2= 20 Marks)

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) The heat transfer coefficient *h* is given by the following equation.

$h = a\left(\frac{C_p G^{0.8}}{D^{0.2}}\right)$, where a = 10.1 when h is measured in Btu/(h.ft^2 ^{0}F), Cp is the specific heat in Btu/(lb ^{0}F), *G* is the mass velocity in lb/(ft^2.s) and *D* the diameter in ft. Determine the value of *a* when *h* is measured in W/(m^2.K), C_p is kJ/(kg.K), *G* in kg/(m^2.s) and *D* in m. (10 Marks)

b) An aqueous solution of NaCl contains 20% NaCl. The density of the solution is 1.16 g/ml. 500 ml water of density 1g/ml is added to 1 liter of the solution. What will be the molality and molarity of the resulting solution? (10 marks)

OR

12. a) An Ammonia converter is charged with a 1:3 mixture of nitrogen and hydrogen at 1000 bar and 500 K. Calculate the following:

i) The partial pressures of nitrogen and hydrogen.
ii) The average molecular weight.
iii) The density of the mixture. (12 marks)

b) State and explain Dalton's Law and Amagat's Law. Prove that the mole % is equal to volume % for ideas gases. (8 marks)

MODULE II

13. a) At 360K the vapor pressure of n-heptane and toluene are respectively 71.2 kPa and 48.9 kPa. Determine the composition of liquid and vapor in equilibrium at 360 K and 65 kPa if it is given that n-heptane and toluene form ideal solutions. (10 marks)

b) Combustion gases having the following molal composition are passed into an evaporator at 200 °C and 743 mm Hg. The composition of the gas is N_2 - 79.2 %, O_2 – 7.2 %, CO_2 - 13.6 %. Water is added to the stream as vapour and the gases leave at 85°C and 740 mm Hg with the following composition. N_2 - 48.3 %, O_2 – 4.4 %, H_2O - 39 %. Calculate (a) Volume of gases leaving evaporator per 100 liter of gas entering and (b) weight of water added per 100 liter of gas entering. (10 Marks)

OR

14. a) What is a key component or tie element? Give examples citing suitable unit operations. (5 marks)

b) Spent acid containing 35% H_2SO_4, 35% HNO_3 and 30% H_2O is to be concentrated by adding con. H_2SO_4 (95% H_2SO_4) and concentrated HNO_3 containing 85% HNO_3. To prepare a charge of 500kg regenerated acid containing 40% H_2SO_4, 45% HNO_3 and 15% H_2O, how many kg of each of the three are to be mixed? (15 marks)

MODULE III

15. a) 500 kg/hr of pure sulphur is burnt with 20% excess air (based on S to SO_2). 5% sulphur is oxidized to SO_3 and rest to SO_2. Find the exit gas analysis. (10 marks)

b) Dry methane and dry air at 298K and 1 bar pressure are burnt with 100% excess air. The standard heat of reaction is -802 kJ/kmol of methane. Determine the final temperature attained by the gaseous products if combustion is adiabatic and 20% of heat produced is lost to the surroundings. (10marks)

OR

16. a) A gas analyzing CO_2 5.5%, CO 25%, H_2 14%, CH_4 0.5%, and N_2 55% is burnt with 10% excess air; Calculate the Orsat analysis of the flue gas. (12 marks)

b) The molar heat capacity of methane is given by

$C_p = 14.16 + 75.42 \times 10^{-3} T - 17.97 \times 10^{-6} T^2$ where, C_p is in kJ/kmol K and T in K.

Calculate a) the mean specific heat between 530 K and 810 K. b) the heat required to raise one kmol of methane from 530K to 810K. (8 marks)

MODULE IV

17. a) Derive the following relationships

(i) $Cp - Cv = \dfrac{\beta^2 VT}{\kappa}$

(ii) $dH = CpdT + \left[V - T\left(\dfrac{\partial V}{\partial T} \right)_P \right] dP$

(iii) Clausius Claperon equation (20 Marks)

OR

18. a) A 50 kg steel casting (C_p= 0.5 kJ /kg °C) at a temperature of 450 °C is quenched in 200 kg of oil (C_p= 2.5kJ /kg °C) at 25 °C. If there are no heat losses, what is the change in entropy of (i) steel casting (ii) the oil and (iii) the quenching process. (10 Marks)

b) 220 kg of CO_2 gas at 27°C and 1 atmosphere is compressed adiabatically to 1/5th of its volume. It is then cooled to its original temperature. Find Q, ΔU, and work done for each step and for the entire process. (10 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.107 PROCESS ENGINEERING CALCULATIONS (H)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

Instructions: *Use of Steam tables and/or Psychrometric Charts are permitted in the examination hall. Missing data, if any, may be assumed suitably.*

PART A

(Answer all questions. Each question carries 2 marks)

1. The depth of microchip is given by the relation $d = 16.2 - 16.2\, e^{-0.021\, t}$, where *d* is the depth of the etch in microns and *t* is the time of the etch in seconds. What are the units associated with the numbers 16.2 and 0.021? Convert the relation so that *d* becomes expressed in inches and t can be in minutes.
2. Find the equivalents of 3 kmol of $Fecl_3$
3. A sample of urea (NH_2CONH_2) contains 42 % nitrogen by weight. What is the percentage purity of the sample
4. A 8 molar aqueous solution of KOH contains 40 % by weight of KOH. What is the density of the solution?
5. Explain recycling, bypassing and purging operations in process industries
6. Explain Principle of corresponding states
7. Define standard heat of formation and standard heat of combustion
8. Determine the specific volume of superheated steam at 1200 kPa and 925 K
9. Explain proximate and ultimate analysis of coal
10. Explain the limitations of first law of thermodynamics 10 x 2= 20 Marks)

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) 250 cubic meters of 30° API gas oil is blended with 1000 cubic meters of 15° API fuel oil. What is the density of the resultant mixture in kg/m^3? The density of water at 288.5 K = 999 kg/m^3. Assume no volume change on mixing. (10 marks)

b) The average molecular weight of a mixture of oxygen and sulphur dioxide is found to be 44.8. For 5 kg of this mixture at 298 K and 200 kPa, calculate

(i) the partial pressure of oxygen

(ii) the volume of the mixture

(iii) the density at standard conditions (10 marks)

OR

12. a) A flue gas has the following composition by volume percent.

CO- 34.8; H_2- 42.0 ; CH_4- 0.4; CO_2- 5.5; O_2-0.2 ; and N_2- 17.1. Calculate

(i) the composition in weight percent

(ii) the average molecular weight

(iii) the density at standard conditions in SI units (10 Marks)

b) The effective heat capacity of a gas mixture is given by

$$C_p = 7.13 + 0.577 \times 10^{-3} T + 0.0248 \times 10^{-6} T^2$$

where C_p is in Btu/(lbmol °F) and T in °F.

(i) What are the units of the constants in the equation?

(ii) Change the equation into the form in which Cp is given in kJ/(kmol. K) and temperature is in K. (10 Marks)

MODULE II

13. a) Spent acid containing 35% H_2SO_4, 35% HNO_3 and 30% H_2O is to be concentrated by adding concentrated. H_2SO_4 (95% H_2SO_4) and concentrated HNO_3 containing 85% HNO_3. To prepare a charge of 500kg regenerated acid containing 40% H_2SO_4, 45% HNO_3 and 15% H_2O, how many kg of each of the three are to be mixed? (10 marks)

b) A solution of potassium dichromate in water contains13% by weight $K_2Cr_2O_7$. 640 kg of water is removed by evaporating 1000kg of solution. The remaining solution is cooled to 20 °C. Calculate the amount and percentage yield of crystals formed. The solubility of $K_2Cr_2O_7$ at 20°C = 0.39 kmol/1000kg water. (10 marks)

OR

14. Hydrochloric acid is obtained by absorbing HCl gas in water. A gas mixture analyzing 30 % HCl and 70 % air enters the absorber at 95 kPa and 320 K and leaves at 90 kPa and 300 K. 95 % of HCl present in the entering gas is absorbed. For 100 m^3 of gas entering the absorber, determine the following.

(i) the volume of gas leaving in m^3

(ii) the mass of HCl absorbed in kg

(iii) the percentage composition by volume of the gases leaving (20 marks)

MODULE III

15. Hydrogen free coke containing 85 % (weight) carbon and the rest inert materials is burned in a furnace. It is found that during combustion 5 % of the coke charged is lost unburned. The flue gas analysis shows 14.84 % CO_2, 1.65 % CO, 5.16 % O_2 and 78.35 % N*2*. The flue gas leaves the furnace at 500 K and 100 kPa. Determine the following:

    (i) The percentage excess air on the basis of complete combustion of coke

    (ii) The weight of air supplied per kg of coke charged

    (iii) The volume of flue gases per kg of coke charged

    (iv) The composition of the refuse from the furnace (20 Marks)

OR

16. a) A gas analyzing CO_2 5.5%, CO 25%,H_2 14%, CH_4 0.5%, and N_2 55% is burnt with 10% excess air. Calculate the Orsat analysis of the flue gas. (10 marks)

    b) Acrylonitrile is produced by

$$C_3H_6 + NH_3 + 3/2\ O_2 \rightarrow C_3H_3N + 3H_2O$$

    The feed contains 420 gm of C_3H_6, 204 gm of ammonia and 2262 gm of air. Find a) which reactant is limiting and by what weight percentage the others are in excess; b) the weight of C_3H_3N produced per kg of C_3H_6 fed with 30 %(mol) conversion of the limiting reactant. (10 marks)

MODULE IV

17. a) Derive the mathematical statement of first law of thermodynamics for flow process. Explain the difference between flow and non flow process. (10 Marks)

    b) Calculate the change in internal energy and enthalpy when 1 kmol of water is vaporized at a constant temperature of 373K and pressure of 101.3kPa. The specific volumes of vapor and liquid at these conditions are 0.00104 and 1.675 m^3/kmol and 10290 kJ of heat is added to the water for vaporization. (10 Marks)

OR

18. a) Explain the significance of Maxwell's equations (5 Marks)

    b) Dicuss the effect of temperature and pressure on heat capacities. Also explain the importance of Joule Thompson coefficient. (7Marks)

    c) Prove the following

$$dS = \frac{C_v}{T}dT - \frac{(\frac{\partial V}{\partial T})_P}{(\frac{\partial V}{\partial P})_T}dV$$ (8 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.107 BASIC BIOCHEMICAL ENGINEERING AND BIOTECHNOLOGY (B)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

Instructions: *Use of Steam tables and/or Psychometric Charts are permitted in the examination hall. Missing data, if any, may be assumed suitably*

PART A

(Answer all questions. Each question carries 2 marks)

1. Mention four major biological functions of proteins.
2. Explain the difference between feedback inhibition and feedback repression with suitable examples.
3. Without elucidating the rate equation, it is predicted that the reaction with a stoichiometry : $N_2 + 3\ H_2 \rightleftharpoons 2\ NH_3$ is non- elementary. Specify the rationale leading to such a conclusion.
4. How is bioprocess engineering distinct from biochemical engineering?
5. What is membrane separation? Mention the common types of membrane separation processes practiced in the bioprocessing sector.
6. A gas mixture contains 20 g of N_2, 83 g of O_2, and 45 g of CO_2. Calculate the composition in mole fraction and determine the average molecular weight of the mixture.
7. Why is specific heat at constant pressure, C_P always greater than that at constant volume, C_V?
8. Determine the entropy change when 2 kg of a gas at 4°C is heated at constant volume to a temperature of 95°C. Take the specific heat at constant volume as 1.42 kJ/(kg K).
9. Briefly explain 'Crabtree effect' and 'Pasteur effect' in the context of microbial metabolism.
10. Calculate the ΔG for hydrolysis of ATP at pH 7 and 25°C under steady- state conditions in which the concentrations of ATP, ADP and P_i are maintained at 10^{-3} M, 10^{-4} M and 10^{-2} M respectively.

PART- B

Answer any one full question from each module

MODULE I

11. a) Briefly describe with neat sketches, the different levels of structural organization in proteins. (15 marks)

b) Calculate the axial length of an α- helix containing 78 amino acids. How long would the polypeptide chain be, if it were fully extended? (5 Marks)

12. a) A batch fermenter was operated for the production of alcohol from glucose using yeast. The following data were obtained in the fermenter:

Time (h)	**0**	**2**	**4**	**6**	**8**	**10**	**12**	**14**
Concentration of glucose (kg mol/m^3)	70	68	66	63	58	52	44	36
Yeast count (x 10^6 cells/ml)	-	6	10	20	38	180	117	140
Alcohol production (kg mol/m^3)	0	1	5	11	20	30	41	55

Find out whether the above rate data could be interpreted by a simple kinetic equation of the type: $-r_A = k_n C_A^n$ where C_A stands for the substrate (glucose) concentration. If so, find k_n and n. If not, indicate the reasons thereof. (10 Marks)

b) Lactase catalyzes the hydrolysis of lactose to produce glucose and galactose from milk and whey. Experiments are carried out to determine the kinetic parameters for the enzyme. Initial rate data are listed below:

Lactose concentration [(*mol / l*) x 10^2]	Initial reaction velocity [(*mol /(l /min*)) x 10^3]
2.50	1.94
2.27	1.91
1.84	1.85
1.35	1.80
1.25	1.78
0.730	1.46
0.460	1.17
0.204	0.779

Evaluate the Michaelis – Menten parameters V_{max} and K_m . (10 Marks)

MODULE II

13. a) The air in a room is at 37.8 °C and at a total pressure of 101.3 kPa containing water vapour with a partial pressure of 3.59 kPa. Calculate:

i) Humidity

ii) Saturation humidity and percentage humidity

iii) Percentage relative humidity (10 Marks)

b) The overall reaction for microbial conversion of glucose to L- glutamic acid is:

$$C_6H_{12}O_6 + NH_3 + 3/2\ O_2 \longrightarrow \underset{\text{(glutamic acid)}}{C_5H_9NO_4} + CO_2 + 3\ H_2O$$

What mass of oxygen is required to produce 15 g glutamic acid?

The molecular weights of oxygen and glutamic acid are 32 and 147 respectively. (4 marks)

c) An inoculum of yeast is added to a solution containing 10 g/l glucose. After some time, only 1 g/l glucose remains while the concentration of ethanol is 3.2 g/l. The fermentation reaction follows the stoichiometry:

$$C_6H_{12}O_6 \longrightarrow 2\ C_2H_5OH + 2\ CO_2$$

Determine:

i) the fractional conversion of glucose to ethanol

ii) the yield of ethanol from glucose (6 marks)

14. a) Outline the classification of industrial fermentation processes. (4 marks)

b) How is the 'unit operations' approach beneficial to bioprocess industries? Categorize various unit operations used in each step of a typical integrated bioprocess and mention the applications of each. (8 marks)

c) Describe the role of bioprocess engineers in an integrated bioprocess, with a suitable case study or example. (8 marks)

MODULE III

15. a) Discuss the physical meaning of the terms 'volume expansivity (β)' and 'isothermal compressibility (κ) ' of pure fluids. Also prove that:

$$\left(\frac{\partial \beta}{\partial P}\right)_T = -\left(\frac{\partial \kappa}{\partial T}\right)_P$$ (10 Marks)

b) For liquid acetone at 20°C and 1 bar, the volume expansivity, β is $1.487 \times 10^{-3}\ °C^{-1}$, the isothermal compressibility, κ is $62 \times 10^{6}\ bar^{-1}$ and specific volume is $1.287 cm^3/g$. Find:

i) The value of $\frac{\partial P}{\partial T}$ at constant temperature.

ii) The pressure generated by heating at constant volume from 20°C and 1 bar to 30°C and 1 bar.

iii) The change in volume for a change from 20°C and 1 bar to 0°C and 10 bar. (10 Marks)

16. a) State and prove the Carnot's theorem and derive the Carnot's equations. (10 Marks)

b) An inventor claims to have devised a process which takes in only saturated steam at 100°C and by which a complicated series of steps makes heat continuously available at a temperature level of 200°C. The inventor claims further that, for every kilogram of steam taken into the process, 2000 kJ of energy as heat is liberated at the temperature level of 200°C. Show whether the process is possible or not. Assume cooling water with a temperature of 0°C is available in unlimited quantity. (10 Marks)

MODULE IV

17. a) Briefly describe any three major metabolic pathways of carbon catabolism. (12 marks)

b) Describe the key biochemical events occurring during photosynthesis. Also comment on the energetics of the process. (8 marks)

18. a) Briefly explain the energetics of active transport across cell membranes. (10 Marks)

b) Glucose- 6 – phosphate was hydrolyzed enzymatically (at pH 7 and 25°C) to glucose and inorganic phosphate. The concentration of glucose- 6- phosphate was 0.1 M at the start. At equilibrium, only 0.05 % of the original glucose- 6- phosphate remained. Calculate:

i) K_{eq}' for the hydrolysis reaction.

ii) K_{eq}' for the reaction by which glucose- 6- phosphate is synthesized from inorganic phosphate and glucose

iii) $\Delta G'$ for the synthesis reaction (10 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.107 BASIC BIOCHEMICAL ENGINEERING AND BIOTECHNOLOGY (B)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

Instructions: *Use of Steam tables and/or Psychometric Charts are permitted in the examination hall. Missing data, if any, may be assumed suitably*

PART A

(Answer all questions. Each question carries 2 marks)

1. How are bacteria classified based on gram reaction? Give examples.
2. Distinguish between glycoproteins and proteoglycans with examples.
3. What do the terms "Amber", "Ochre" and "Opal" signify?
4. What are the limitations of solid state fermentation over submerged fermentation? Mention any two industrial bioproducts produced by solid state fermentation.
5. Mention the applications of the following unit operations in the bioprocessing sector:
   a) Evaporation b) Sedimentation c) Ion- Exchange d) Crystallization
6. A solution of specific gravity 1.0 consists of 35 % by weight of A and the remaining B. If the specific gravity of A is 0.7, what would be the specific gravity of B?
7. One mole of gas in a closed system undergoes a four- step thermodynamic cycle. Using the data provided, determine the numerical values of the missing quantities in the following table:

Step	ΔU	Q	W
1-2	-200	?	-6000
2-3	?	-3800	?
3-4	?	-800	300
4-1	4700	?	?
1-2-3-4-1	?	?	-1400

8. State the three- parameter theorem of corresponding states and define 'acentric factor'.

9. Depict the Calvin- Benson cycle for autotrophic metabolism.
10. Calculate the ΔG° for the complete oxidation of lactic acid to CO_2 and H_2O given the information below:

$$2 \text{ lactic acid} + 6\ O_2 \longrightarrow 6\ CO_2 + 6H_2O$$

$$\text{Glucose} \longrightarrow 2 \text{ lactic acid} \qquad \Delta G'_1 = -52{,}000 \text{ cal/mole}$$

$$\text{Glucose} + 6O_2 \longrightarrow 6\ CO_2 + 6\ H_2O \qquad \Delta G'_2 = -686{,}000 \text{ cal/mole}$$

Also calculate the number of moles of ATP that could be synthesized in the process at 40 % efficiency. (10 x 2= 20 Marks)

PART- B

Answer any one full question from each module

MODULE I

11. a) Briefly describe, with the aid of a neat sketch, the steps involved in mRNA synthesis by gene transcription. (10 Marks)

    b) Describe the key modifications which proteins undergo during post- translational processing. Also elaborate on the physiological significance of such modifications in higher eukaryotes. (10 Marks)

12. a) *Aspergillus niger* is used to produce gluconic acid by batch fermentation. Gluconic acid concentration measured as a function of time for the first 39 hours of the culture is as given below:

Time (hours)	Acid concentration (g/l)
0	3.6
16	22
24	51
28	66
32	97
39	167

Prove graphically that gluconic acid production by *Aspergillus niger* is a first order reaction. (5 Marks)

b) Determine the rate constant for the reaction and estimate the product concentration after 20 hours. (5 Marks)

c) Derive the Michaelis- Menten equation for single substrate enzyme catalyzed reactions. Specify all pertinent assumptions. Also explain the analytical methods for determining the rate parameters of the Michaelis – Menten equation.

(10 Marks)

MODULE II

13. It is intended to manufacture a new DNA- derived bioproduct at the commercial scale. Explain the detailed sequence of steps to be followed in the development of the complete bioprocess to achieve this objective. Append a suitable sketch.

(20 marks)

14. a) Air at 30°C and 150 kPa in a closed container is compressed and cooled. It is found that the first droplet of water condenses at 200 kPa and 15°C. Calculate the percent relative humidity of the original air. The vapor pressure of water at 15°C and 30°C are 1.7051 kPa and 4.246 kPa respectively. (8 marks)

b) A sample of wine contains 20 % alcohol (ethanol) on volume basis. Find the mass % of alcohol in the wine. Assume the densities of alcohol and alcohol free liquid (essentially water) to be 0.79 kg/l and 1.0 kg/l respectively. (6 marks)

c) Gas leaving a fermenter at close to 1 atm pressure and 25°C has the following composition: 78.2 % nitrogen, 19.2 % oxygen, 2.6 % carbon dioxide. Calculate:

i) the mass composition of the fermenter off- gas

ii) the mass of CO_2 in each cubic metre of gas leaving the fermenter. (6 marks)

MODULE III

15. a) Air is compressed from an initial condition of 1 bar and 25°C to a final state of 5 bar and 25°C by three different mechanically reversible processes in a closed system:

i) Heating at constant volume followed by cooling at constant pressure

ii) Isothermal compression

iii) Adiabatic Compression followed by cooling at constant volume

Assume air to be an ideal gas with constant heat capacities, $C_V = (5/2)\ R$ and $C_P = (7/2)\ R$. Calculate the work required, heat transferred, and the changes in

internal energy and enthalpy of air for each process. Given the molar volume of air at 25°C and 1 bar is 0.02479 m^3/mol. (12 marks)

b) Calculate the change in internal energy of 25 kmol of CO_2 gas when it is isothermally expanded from 10132 kPa to 101.32 kPa at 373 K, the corresponding molar volumes being 0.215 m^3/kmol and 30.53 m^3/kmol. Assume CO_2 to obey the equation of state: $(P+365/V^2)$ (V- 0.043) = RT (8 marks)

16. a) Show that for a gas obeying Van der Waals equation of state,

$$C_P - C_V = \frac{R}{1-2\,a(V-b)^2/\,(RTV^3)}$$

where, a and b are the Van der Waals constants. (10 Marks)

b) A gas obeys the relation P(V- b) = RT and has a constant C_V. Show that:

i) U is a function of temperature alone

ii) γ is a constant

iii) $P(V - b)^{\gamma}$ is constant for a reversible adiabatic process. (10 marks)

MODULE IV

17. a) Describe the process of ATP generation by oxidative phosphorylatio.

(10 Marks)

b) Describe the fermentation pathway for production of ethanol from glucose by *Saccharomyces cerevisiae.* (10 Marks)

18. a) Describe the various mechanisms of active transport across cell membranes.

(10 Marks)

b) The conversion of glucose to lactic acid has an overall $\Delta G'$ of -52,000 cal/mole. In an anaerobic cell, this conversion is coupled to the synthesis of 2 moles of ATP per mole of glucose.

i) Calculate the $\Delta G'$ of the overall coupled reaction.

ii) Calculate the efficiency of energy conservation in the anaerobic cell.

iii) At the same efficiency, how many moles of ATP per mole glucose could be obtained in an aerobic organism in which glucose is completely oxidized to CO_2 and H_2O ($\Delta G'$ = - 686,000 cal/mole)? (10 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.108 BASIC ELECTRICAL ENGINEERING (ABCHMNPSTU)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

PART A

(Answer all questions. Each question carries 2 marks)

1. State and explain Kirchoff's laws.
2. "Lenz's law is in accordance with law of conservation of energy" Justify your answer.
3. Derive the RMS and average values of a half wave rectified sine wave.
4. Obtain the relationship between line and phase values of current in a three phase star connected circuit.
5. Three impedances (4+j3)Ω are connected in delta across three phase 200V supply. Find the line current, power factor and active power.
6. What are the advantages of polyphase systems?
7. Which are the losses occurring in a single phase transformer?
8. Explain the necessity of starters in Dc motors.
9. Give the difference between slip ring and squirrel cage induction motor.
10. What are the uses of lead acid battery?

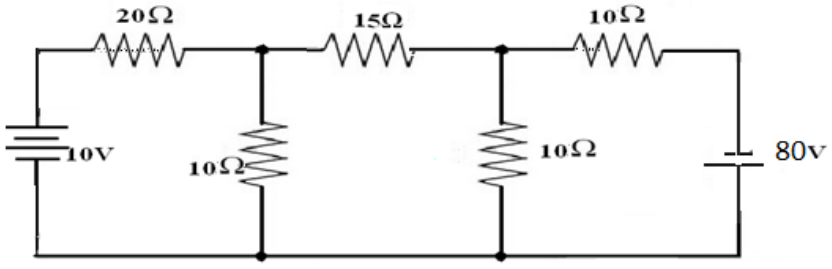
PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

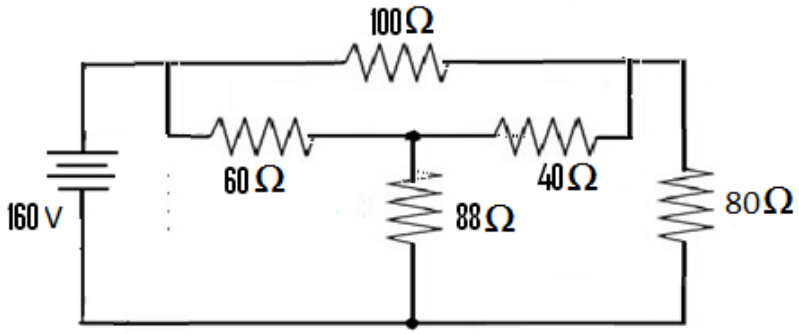
11. a) Define Magnetomotive force, Magnetic field strength, Reluctance and Permeance (10 Marks)

b) Solve the following circuit using node voltage method (10 Marks)



OR

12. a) Determine the resistance between the terminals A and B and also the currents of the circuits given below. (10 Marks)



b) A sinusoidal current of frequency 50 Hz has rms value of 10A. Write down the equation for the instantaneous value and find this value at 0.00125 Sec. after passing through a positive maximum value. At what time, measured from the positive maximum value, will the current be 7.07 A (10 Marks)

MODULE II

13. a) With a neat block schematic diagram, explain the working of a thermal power plant. List the advantages and disadvantages. (10 Marks)

b) A star connected 3 phase consists of three identical impedances. When the load is connected to a 3 phase 400V supply, the line is 23.09A, at a power factor of 0.8 lagging. Calculate the total power taken by the load, if two wattmeter method is used to measure power, calculate the readings indicated by each wattmeter and commend on your results. (10 Marks)

OR

14. a) Explain the construction and principle of operation of a dynamometer type wattmeter with a neat diagram. (10 Marks)

b) A 250KVA, 11 KV, 3 phase, 50Hz star connected alternator is supplying full load power at 0.8 pf lagging. Calculate the phase voltage, line current, kVAR rating of the power factor improvement device to raise the power factor to unity. (10 Marks)

MODULE III

15. a) Describe the construction and working of a single phase transformer.

(10 Marks)

b) A short shunt cumulative compound generator supplies 50 KW at 250 volts. The shunt field, series field and armature resistance are 200Ω, 0.1 Ω and 0.25 Ω respectively. Calculate the induced emf and the load resistance. (10 Marks)

OR

16. (a) Explain why single phase induction motors are not self-starting. (2 Marks)

(b) Explain any four methods by which single phase induction motor can be made self- starting (8 Marks)

(c) A 100 KVA, single phase transformer gave the following test results:

Open Circuit test Power = 70 watts

Short Circuit test power = 400 watts

Calculate the efficiency of the transformer on

(i) Half Full load and (ii) Full load (10 Marks)

MODULE IV

17. a) Explain the difference between MCB and ELCB used for the protection of electric circuits (2 Marks)

b) With a neat diagram explain the working of ELCB (8 Marks)

c) Explain in detail the different types of tariff schemes (10 Marks)

OR

18. a) Explain with a neat diagram any one method of earthing . (10 Marks)

b) Explain the charging methods of storage batteries what is the need to avoid the overcharging of batteries. (10 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.108 BASIC ELECTRICAL ENGINEERING (ABCHMNPSTU)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

PART A

(Answer all questions. Each question carries 2 marks)

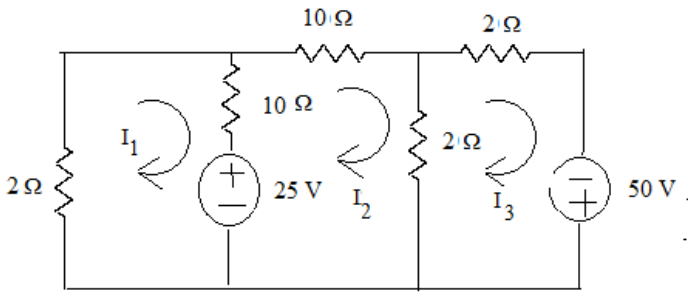
1. State and Explain Kirchoff's Law.
2. An alternating current is represented by i(t) = 70.7 sin 520 t. Determine (i) Frequency (ii) Current 0.0015 seconds after passing through zero increasing positively.
3. Explain the term Mutual Inductance.
4. Explain Primary Transmission System.
5. What is the Principle of operation of dynamometer type Wattmeter?
6. Draw the block schematic diagram of a Nuclear Power Plant.
7. Derive E.M.F. equation of a Transformer.
8. What are the applications of a synchronous Motor?
9. What is the function of a Ballast in a Fluorescents Lamp Circuit?
10. Give the schematic Layout of an LT Switch Board

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) Solve the currents I_1, I_2 and I_3 using Mesh Current Method.



(10 Marks)

b) A coil of turns and of resistance 10 Ohms is wound uniformly over a steel Ring of mean circumference 30 cm and cross sectional area 9cm^2. It is connected to a supply of 20 V DC if the relative permeability of the ring is 1500. Find (i) Magnetizing force (ii) Reluctance (iii) M.M.F, and (iv) Flux. (10 Marks)

OR

12. a) A Coil of resistance 10 ohms and inductance 0.2 Henry is connected in series with a capacitor of 150 μF across a 200 V, 50 Hz supply.
Find (i) Current (ii) Power (iii) Power factor and (iv) Voltage across the coil.
Draw the Phasor diagram. (10 Marks)

b) Derive the R.M.S. value and Average value of a Sinusoidal Wave form. (10 Marks)

MODULE II

13. a) Obtain the relation between Line and Phase Values of Voltage and Current for a delta connected system. (10 Marks)

b) Write in detail about two methods of non-Conventional Energy Sources. (10 Marks)

OR

14. a) With a neat diagram explain the Power measurement in a 3 phase circuit using two wattmeters (10 Marks)

b) Three similar coils, each of resistance 20 Ω and inductance 0.5 H, are connected in Star to a 3phase, 400V, 50 Hz supply. Calculate the current drawn from the supply and the power consumed. (10 Marks)

MODULE III

15. a) Explain the principle of operation of a 3Ø Induction Motor. Draw the Torque - Slip Characteristics and indicate the operating Points. (10 Marks)

b) Describe the construction and working of a DC Generator. (10 Marks)

OR

16. a) Derive the EMF Equation of an Alternator. (5 Marks)

b) In a 40KVA Transformer the Iron loss is 500 W and Full Load copper loss is 700W. Find the efficiency at Full Load at 0.8 Pf Lagging. (5 Marks)

c) Explain the principle of operation and any one starting Method of Synchronous Motor. (10 Marks)

MODULE IV

17. a) What is the necessity of earthing. With neat sketch explain Pipe earthing. (10 Marks)
    b) With a neat sketch explain the working of ELCB. (10 Marks)

OR

18. a) Explain the construction and principle of operation of a Lead acid Battery.(10 Marks)
    b) Compare Sodium Vapour Lamp and Mercury Vapour Lamp. (10 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.108 BASIC ELECTRICAL ENGINEERING (ABCHMNPSTU)

MODEL QUESTION PAPER – III

Time : **3 Hours** Maximum Marks : **100**

PART A

(Answer all questions. Each question carries 2 marks)

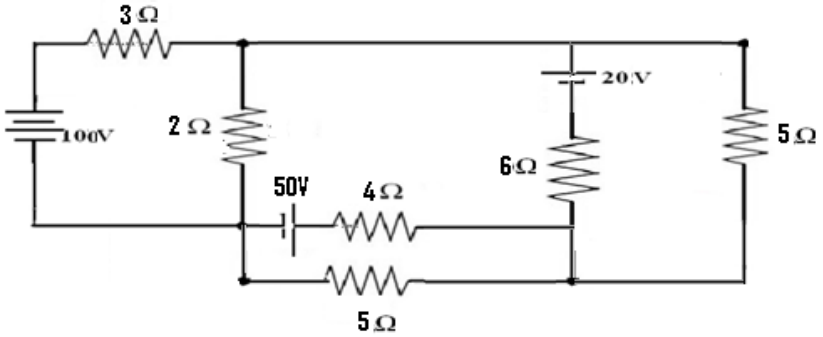
1. Define constant voltage source and constant current source
2. An EMF of 20V is induced in a coil of self inductance 4H. What must be the rate of change of current?
3. Three resistances each of value 2Ω are connected in delta. What will be the equivalent value of resistances when they are connected in star?
4. Define active and reactive power in three phase AC systems.
5. Draw a typical electrical power transmission scheme.
6. Mention different losses in a transformer. What is the condition for maximum efficiency?
7. Differentiate between slip ring and squirrel cage induction motors.
8. Derive the EMF equation of Dc generator
9. Draw the schematic of LT switch board.
10. Describe the control accessories of vapour lamps.

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) Find the current through the 4Ω resistor shown in the figure by using nodal analysis. (10 Marks)



b) An iron ring has a mean diameter of 300mm and a cross sectional area of 170 mm^2 and radial gap of 0.5 mm cut in it. It is uniformly wound with1500 turns and a current of 1A flows through the winding produces flux of 0.1 mwb across the gap. Calculate the relative permeability of iron, neglecting magnetic leakage. (10 Marks)

OR

12. a) Explain different types of induced EMF's. (10 Marks)

b) Find the form factor of a saw-tooth waveform of voltage. (5 Marks)

c) Show that the average power of a purely inductive circuit is zero. (5 Marks)

MODULE II

13. a) Three inductive coils, each of inductance 50 mH are connected in star to a 3 phase, 200V, 50Hz systems. Calculate the inductance of each coil, which when connected to the same supply will take the same current. (10 Marks)

b) Explain with the help of a neat diagram, 2 wattmeter method of 3 power measurement. (10 Marks)

OR

14. a) With the help of schematic layout, describe the working of thermal power plant. (10 Marks)

b) Explain the different equipments used in a substation (5 Marks)

c) With the help of circuit diagram explain the method of power factor improvement using a capacitor (5 Marks)

MODULE III

15. a) A 25 KVA transformer has 500 turns on the secondary winding. The primary is connected to 3000 V, 50 Hz mains. Calculate (i) Primary and secondary current on full load (ii) secondary EMF (iii) The maximum flux in the core. Neglect magnetic leakage. (10 Marks)

b) Explain in detail, with the help of a neat diagram, the different types of DC generator. (10 Marks)

OR

16. a) Explain the working principle of a single phase induction motor. (10 Marks)

b) Draw the Torque Slip characteristics of a three phase induction motor and comment on it. (10 Marks)

MODULE IV

17. a) A power station is to supply 4 regions of load, whose peak load are 9000 KW, 6000KW, 7000KW and 11000 KW. The diversity factor of the load of the station is 60%. Calculate the maximum demand on the station and the annual energy supplied from the station. (10 Marks)

b) What is the necessity of earthing? With the help of a neat diagram, explain pipe earthing. (10 Marks)

OR

18. a) Explain the working of fluorescent lamp (10 Marks)

b) Explain the construction and performance of lead-acid battery (10 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.108 FUNDAMENTALS OF ELECTRICAL ENGINEERING (E)

MODEL QUESTION PAPER – I

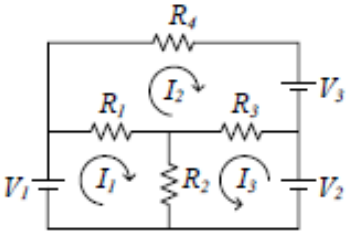
Time : **3 Hours** Maximum Marks : **100**

Instruction: Graph sheet may be supplied

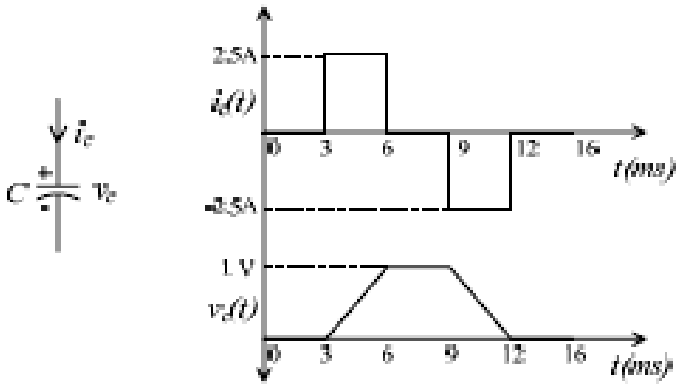
PART A

(Answer all questions. Each question carries 2 marks)

1. Draw the terminal voltage-current (v-i) characteristics of the two-terminal circuit elements: (a) Ideal current source (b) Linear resistor.
2. In the circuit shown below, mesh currents I_1, I_2 and I_3 are assumed in the shown directions. Write down the resistance matrix by inspection.

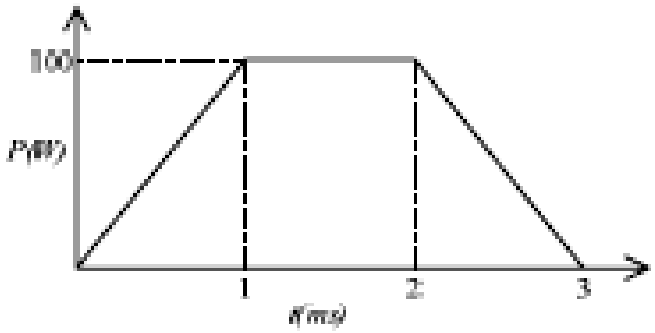


3. The voltage $v_C(t)$ across and the current $i_C(t)$ through a capacitor C are as shown in the figure below. Evaluate the value of capacitor and the energy in it at t = 6 ms.



4. State reciprocity theorem.

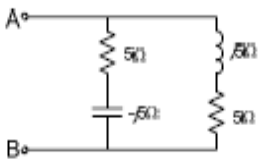
5. The instantaneous power absorbed in a two-terminal element is as shown in figure below. Evaluate the energy at the end of t = 2ms and t = 3ms.



6. Express $i(t) = 20\sin(628t - \frac{\pi}{3})$ in exponential, polar and rectangular forms.

7. A resistor 2.5Ω is in series with a reactance j2.5 Ω. The series combination is supplied with an AC source 50∠0 V. Evaluate the power dissipated in the circuit.

8. A pure sinusoidal ac source is connected across the terminals A and B of a passive network as shown in figure below. State whether the load appears as a resistive, inductive or capacitive one at the terminals A and B. What is the power factor?



9. An ac source $V_{ac}(t) = 125 \sin(\omega t)$ is feeding a series R-L-C circuit with R = 2.5Ω, L = 5mH and C = 60μF. The frequency ω of the source is variable, find the maximum possible current in the circuit.

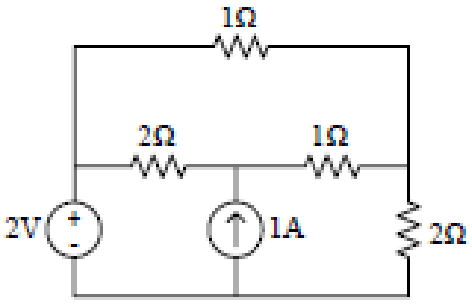
10. Define time-constant. (10 x 2 Marks = 20Marks)

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

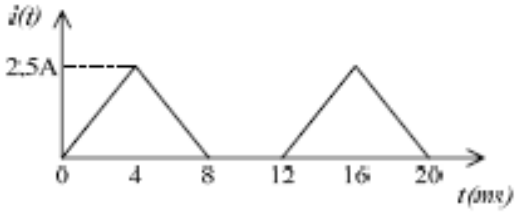
MODULE I

11. a) Evaluate the power dissipated in the resistors and the power delivered/ or absorbed by the sources in circuit shown in the figure below using mesh current method. Verify that the total power delivered is equal to the total power absorbed.



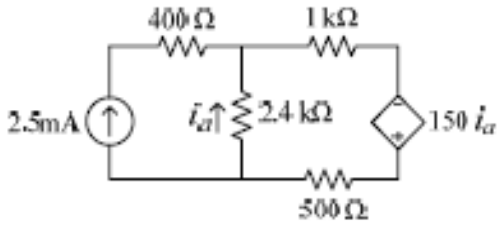
(12 Marks)

b) In the figure below, the current through a pure inductor of value L = 0.5H is shown. Plot the voltage $v_L(t)$ across the inductor for the first 20 ms. Evaluate the peak energy stored in the inductor. *(4 Marks)*

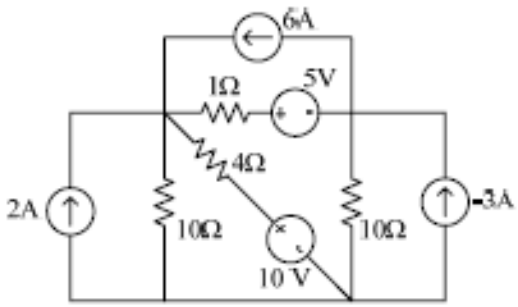


c) Use mesh current method to solve for the current i_a in the figure below. Find the power delivered by the independent and dependent sources in the circuit.

(4 Marks)



12. a) Compute the power delivered/absorbed by all the sources in the circuit shown in figure below, using nodal analysis. (14 Marks)

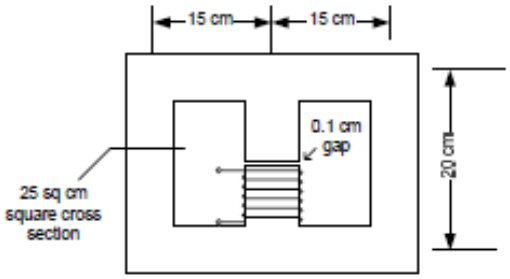


b) Define mutual inductance and coupling coefficient. (4 Marks)

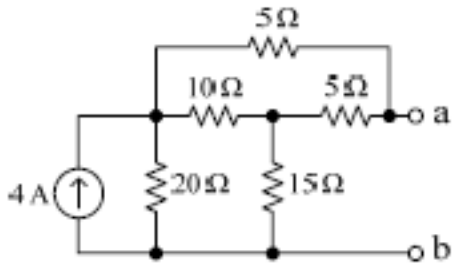
c) Give two examples each of linear and nonlinear elements. (2 Marks)

MODULE II

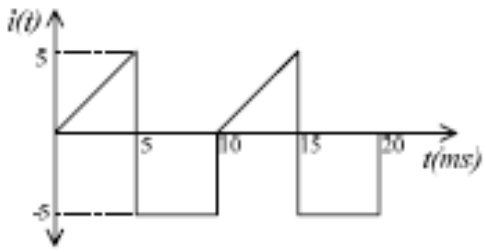
13. a) A flux of 2 mWb is to be produced in the air gap of the magnetic circuit shown in figure below. How much ampere turns the coil must provide to achieve this? The air gap is 0.1cm; Relative permeability μ_r of the core material may be assumed to be constant and equal to 5000. All the dimensions shown are in cm and the sectional area is 25cm^2 throughout. The cross-section is square in shape. Neglect the effects of fringing and leakage. (12 Marks)



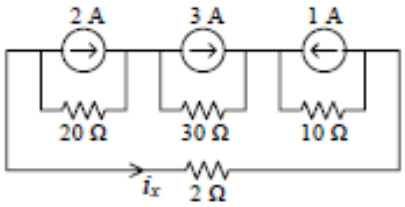
b) Obtain the Thevinin equivalent circuit at the terminals a and b of the circuit shown below. (8 Marks)



14. a) Evaluate the rms and average values of the current waveform below. (6Marks)



b) Find the current i_x and power dissipated in all the resistors using superposition theorem in the figure below. (10 Marks)

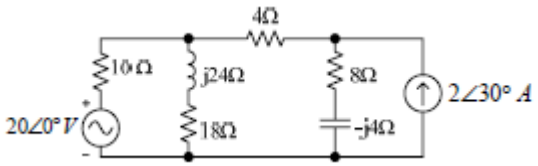


c) State Millman's theorem. (4 Marks)

MODULE III

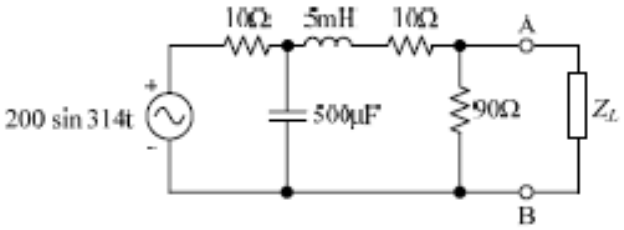
15. a) Find the Thevinin equivalent circuit across terminals of the 4Ω resistance in the circuit shown in the figure below, and evaluate the current in the 4 Ω resistor.

(10 Marks)



b) A three-phase, three-wire 415-V system is connected to a balanced three-phase load. The line currents I_A, I_B and I_C are given to be in phase with the line-to-line voltages V_{BC}, V_{CA} and V_{AB}, respectively. If the line current is measured to be 10 A, find the per-phase impedance of the load; (a) If the load is star-connected and (b) If the load is delta connected. (10 Marks)

16. a) Find out the load impedance Z_L to be connected at the terminals A and B of the circuit shown in the figure below for maximum power transfer to it. The source voltage is 200 sin(314t) volts. (6 Marks)



b) A balanced Y- connected load with a per-phase impedance of (4 + j3) Ω is supplied by a 415V, 50Hz three-phase source. (a) Find line current, power factor, total volt-amperes, real power, and reactive power absorbed by the load. (b) Sketch the phasor diagram showing all the voltages and currents, with V_{AB} as the reference. (c) If the star point of the load is connected to the system neutral through an ammeter, what would the meter read? (14 Marks)

MODULE IV

17. a) An inductor L=10mH with a winding resistance of 0.5Ω is initially relaxed. At t=0, a dc voltage of 1V is applied across it. At time t = τ ms, (where τ is the time-constant of the circuit) the input voltage polarity is reversed. Evaluate the expression of current

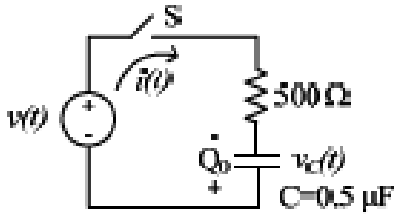
through it for $0 < t < 2\tau$ and $t > \tau$. Draw the current waveform from t=0 onwards.

(10 Marks)

b) With a neat diagram, explain the principle of an Earth Leakage Circuit Breaker.

(10 Marks)

18. a) The RC circuit shown in the figure below has an initial charge on the capacitor Q_0=25μC, with polarity as indicated. The switch is closed at t = 0, applying a voltage $v(t)$ = 100sin(1000t+30°) V. Obtain the current for t> 0. (10 Marks)



b) Draw a neat diagram of standard pipe earthing installation. (10 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.108 FUNDAMENTALS OF ELECTRICAL ENGINEERING (E)

MODEL QUESTION PAPER – II

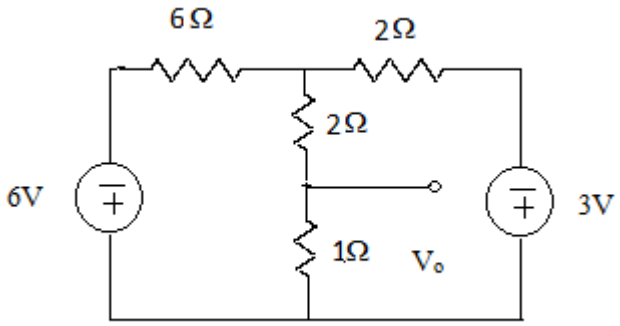
Time : **3 Hours** Maximum Marks : **100**

Instruction: Graph sheet may be supplied

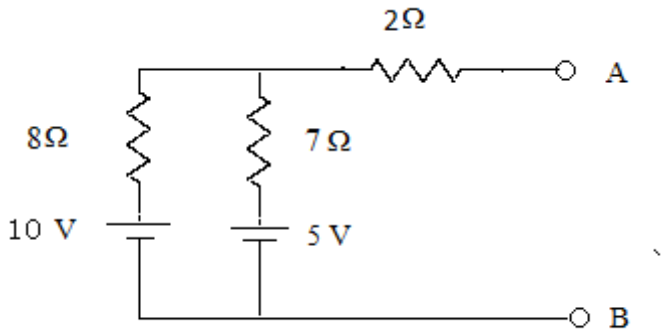
PART A

(Answer all questions. Each question carries 2 marks)

1. How are ideal current and voltage sources defined? In what ways are practical voltage and current sources different from ideal sources?
2. State Faraday's laws of electromagnetic induction.
3. Using nodal analysis find the voltage V_0 for the circuit below.



4. State Norton's theorem.
5. Find Thevenin's equivalent across the terminals AB in the circuit below.



6. Define effective value of an alternating quantity.
7. A series connected load draws a current i(t)= 4 cos (100π t +10)A. when applied voltage is V(t) =120 cos (100πt -20)V. Find the value of load impedance and circuit power factor.
8. Explain the term 'phase sequence' as applied to polyphase circuits.
9. Define Time constant.
10. Explain the necessity of earthing in electrical installations.

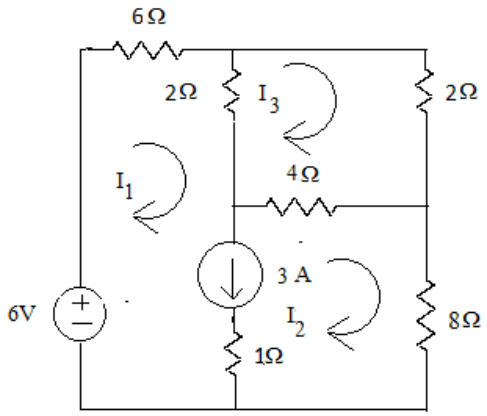
PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

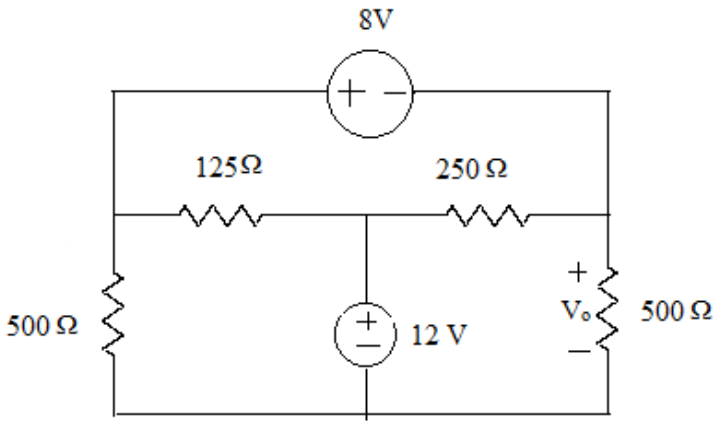
11 a). Compare mesh and nodal analysis for circuits. (6 Marks)

b). Use Mesh analysis to determine currents I_1 , I_2 , and I_3 in the circuit below. (14 Marks)

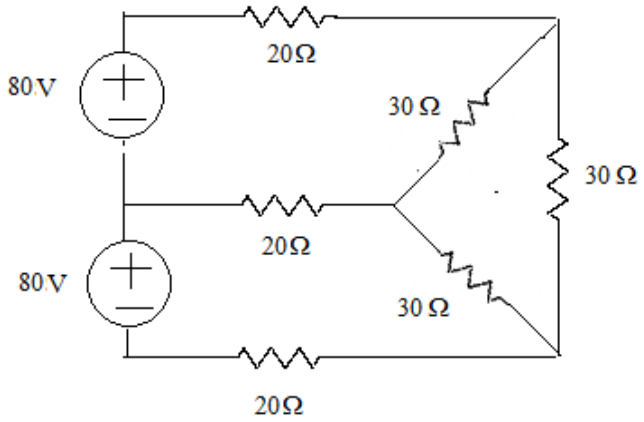


OR

12 a).Find V_0 for the circuit below using nodal analysis. (10 Marks)



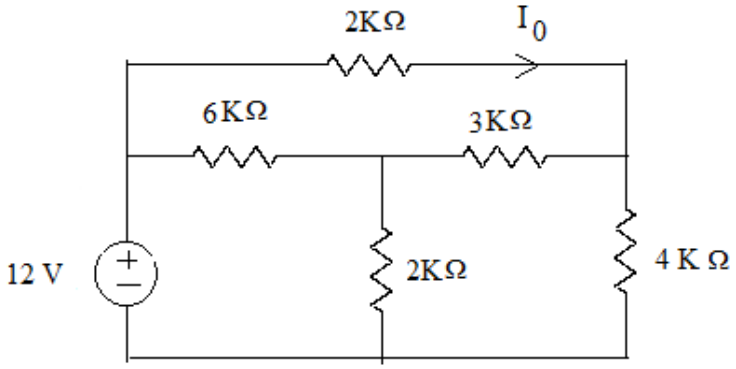
b). Write the mesh equations for the circuit below. (10 Marks)



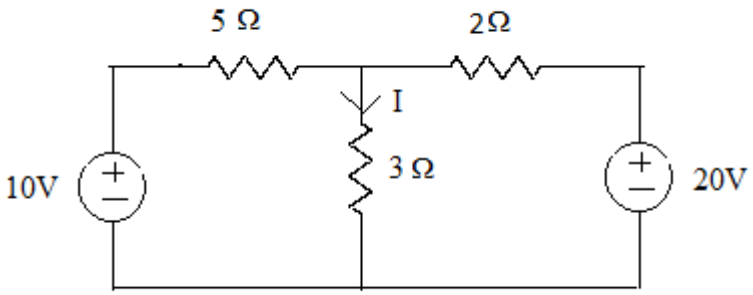
MODULE II

13 a). State and explain superposition theorem. (6 Marks)

b). Find the current I_0 using Norton's theorem for the circuit below. (8 Marks)

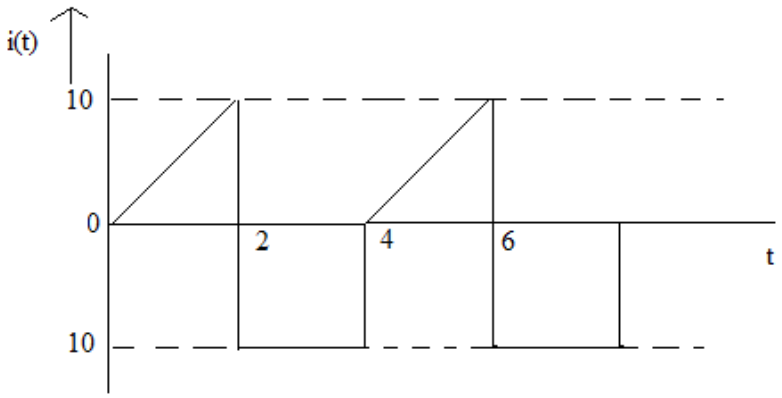


c). Calculate current 'I' in the circuit below using Millman's Theorem. (6 Marks)



OR

14 a) Determine the RMS value of the current waveform below. If the current is passed through a 2Ω resistor, find the average power absorbed by the resistor. (10 Marks)

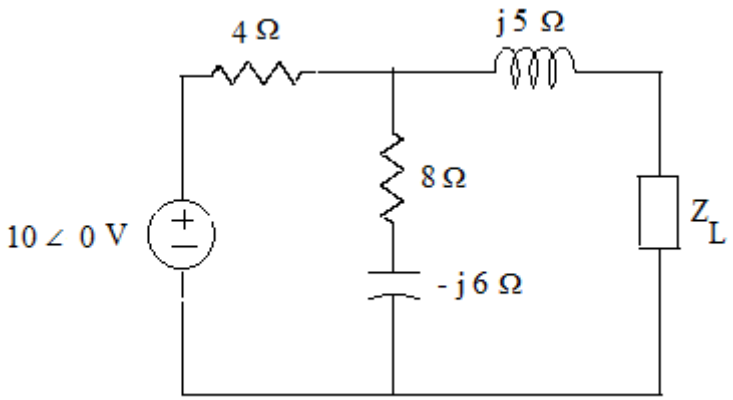


b) An iron ring with a mean length of magnetic path of 20 cm and of small cross section has an air gap of 1mm.It is uniformly wound with a coil of 440 turns. A current of 1A in the coil produces a flux density of $16\pi * 10^{-3} Wb/m^2$. Neglecting magnetic leakage and fringing, calculate the relative permeability of iron. (10 Marks)

MODULE III

15 a) Derive the relation between line voltage and phase voltage, line current and phase current in a star connected system. (10 Marks)

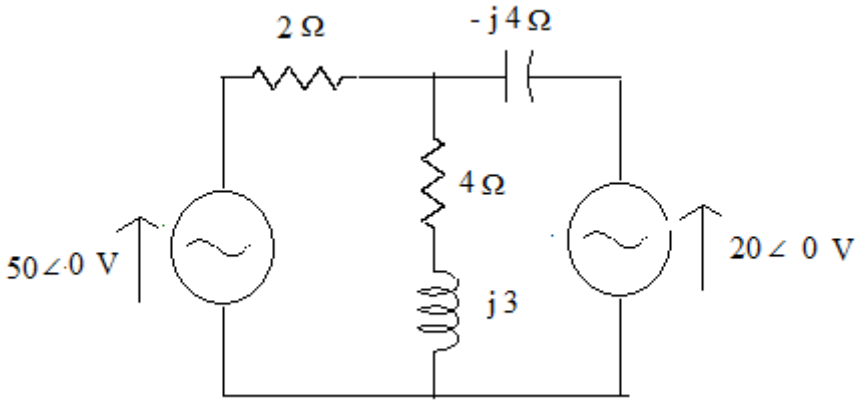
b).Determine the load impedance Z_L that maximizes the average power drawn for the circuit below. What is the maximum average power? (10 Marks)



OR

16 a) Prove that the power consumed by a pure inductor is zero. (6Marks)

b).For the circuit given below, determine the current in (4+j3)Ω using superposition theorem. (14 Marks)



MODULE 1V

17. a). Explain D.C. response of a RC network. (10 Marks)

b). Sketch the variation of impedance and admittance in series and parallel resonant circuits. (10 Marks)

OR

18 a) Distinguish between steady state response and transient response. (5 Marks)

(b). Explain the terms bandwidth, and Q-factor (5 Marks)

(c).Sketch the schematic diagram of a LT switch board. (10 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.108 FUNDAMENTALS OF ELECTRICAL ENGINEERING (E)

MODEL QUESTION PAPER – III

Time : **3 Hours** Maximum Marks : **100**

Instruction: Graph sheet may be supplied

PART A

(Answer all questions. Each question carries 2 marks)

1. State and explain Kirchhoff's voltage and current laws.
2. Define coefficient of coupling.
3. What is a linear circuit?
4. State and explain Lenz's law.
5. Define peak factor of an AC wave.
6. A source has an emf of 10V and an impedance of 500+j100Ω. Calculate the amount of maximum power transferred to the load?
7. What is Resonance?
8. What is the necessity of Earthing?
9. Define Quality factor of an RLC series circuit.
10. Write the time constants for RL and RC networks.

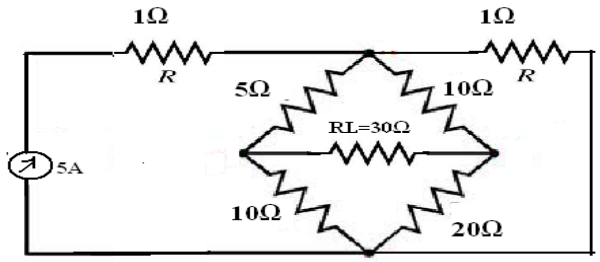
(10 x 2 Marks = 20Marks)

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) Find current through resistor RL using nodal analysis. (16 Marks)



b) Explain with V-I characteristics, an ideal independent electrical source. (4 Marks)

OR

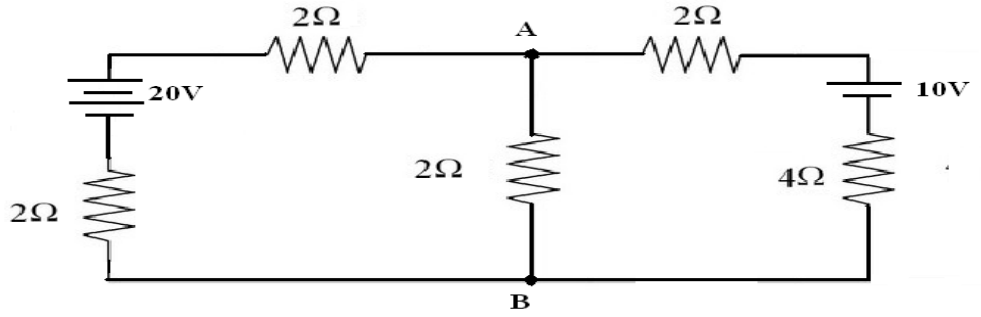
12. a) Deduce the expression for power and energy in two terminal inductor and capacitor. (10 Marks)

b) Two identical 1000 turns coil A and B lie in parallel plane such that 60% of line of flux produced by one coil link the other. A current of 5A in A produces in it a flux of 0.05 mWb. If the current in A changes from +6 to -6 in 0.01 sec, what is the voltage induced in coil B? Calculate the self and mutual inductance of each coil.

(10 Marks)

MODULE II

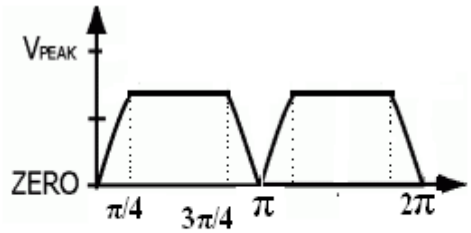
13. a) Determine the current through branch AB of the given network using Thevenin's theorem. (14 Marks)



b) Define the terms (i) mmf, (ii) Flux Density and(iii)Reluctance. (6 Marks)

OR

14. a) Find out the Average and RMS values of the following voltage waveform.



(12 Marks)

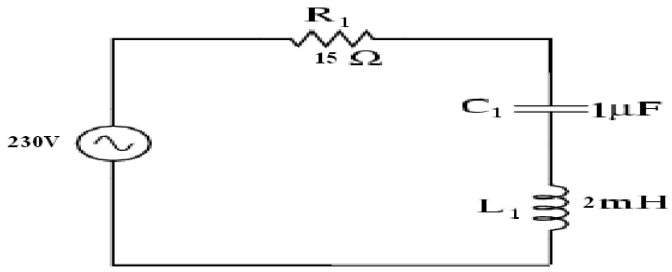
b) A mild steel ring of 30 cm mean circumference has a cross sectional area of 60 cm^2 and has 500 turns in it.The ring is cut through at a point so as to provide an airgap of 1mm in the magnetic circuit.It is found that a current of 5A in the winding produces flux density of 1T in the air gap. Find,

(i) Relative permeability of mild steel.

(ii) Inductance of the winding. (8 Marks)

MODULE III

15. a) Determine (i)current, (ii)Voltage across L and C, (iii)Power delivered to R for the following circuit. (14 Marks)

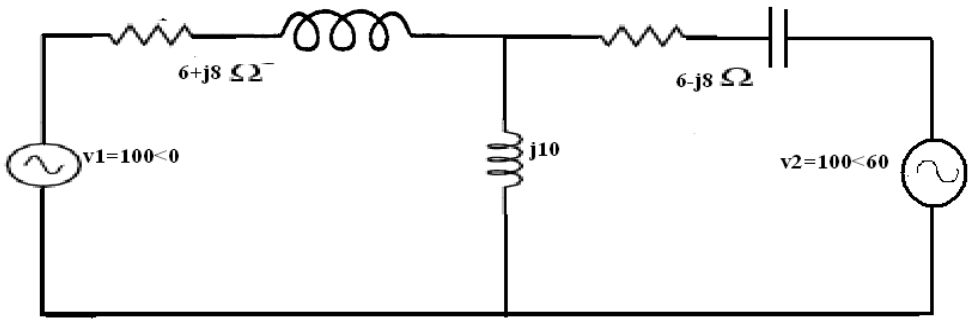


b) Define for an AC system i) Active power. ii) Reactive power. iii) Power Factor.

OR

16. a) Obtain the relationship between line and phase values of voltages and current in three phase delta and star connections. (12 Marks)

b) Find the current through $j10\Omega$ using Mesh analysis. (8 Marks)



MODULE IV

17. a) Derive expression for time constant of an RC network excited by a step input. (10 Marks)

b) Explain pipe earthing with suitable sketches. (10 Marks)

OR

18. a) In a series resonant circuit, R=6Ω. The resonant frequency is 0.5 MHz and the bandwidth is 10^5rad/sec.Compute Land C of the network (10 Marks)

b) With neat sketches explain the working of ELCB. (10 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.108 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (FR)

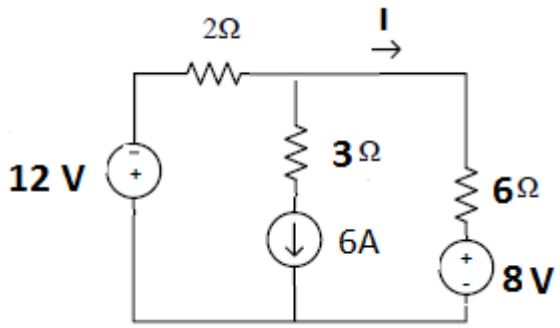
MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

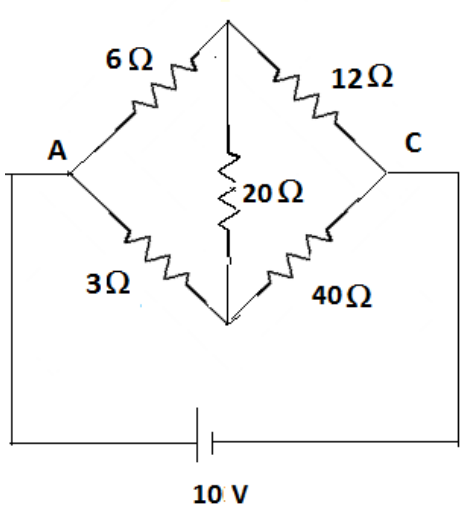
PART A

*(Answer all questions. Each question carries **2** marks)*

1. State and explain reciprocity theorem
2. Determine the current "I" in the following circuit by super position theorem



3. Determine the current in the 20 Ω resistor of the network shown in figure using Thevenin's theorem



4. Derive the expressions for coupling coefficient. What is the indication of K?
5. Show that the power consumed by the three identical phase loads connected in delta is equal to three times the power consumed when the phase loads are connected in star.

6. Explain the working principle of dynamometer type wattmeter.
7. Explain briefly the different losses in a transformer.
8. Explain the working principle of stepper motor.
9. What is ripple factor? What is its value for half wave and full wave rectifier circuits?
10. Explain the principle of DIAC.

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) Derive the expression for quality factor in series resonant circuit (7 Marks)

    b) A 10mH coil is connected in series with a loss free capacitor to a variable frequency source which supplies a constant voltage of 10V. The circuit current has a maximum value of 0.1 A at a frequency of 80 KHz.

    Calculate (i) the capacitance of the capacitor (ii) the Q factor of the coil and (iii) the ct off frequencies. (7 Marks)

    c) An uncharged capacitor "C" in series with a resistor "R" is connected to a constant supply voltage "V".

    (i) Why does the voltage across the capacitor rise slowly?

    (ii) Write down an expression for voltage across the capacitor after t seconds.

    (iii) Sketch a curve of voltage against time.

    (iv) What is the meaning of time constant of the circuit? (6 Marks)

OR

12. a) Find out the natural response and forced response for a series RL circuit with applied DC voltage "V". (7 Marks)

    b) A resistance "R" and a 2 micro Farad capacitor are connected in series across a 250V Dc supply. Across the capacitor is neon lamp that strikes at 150V. Calculate "R" to make the lamp strikes 5 seconds after closing the switch. (6) Marks

    c) State and prove maximum power transfer theorem (7 Marks)

MODULE II

13. a) A magnetic core is in the form of a closed ring has a mean length of 20cm and a cross section of 1 cm^2. The relative permeability of iron is 2400. What direct

current will be needed in a coil of 2000 turns uniformly wound round the ring to create a flux of 0.2 Mwb in the iron (10 Marks)

b) With the help of block diagram explain the working of CRO (10 Marks)

OR

14. a) Three identical resistors of 20 Ω are connected in star to a 415 V, 3 phase, 50 Hz supply. Calculate (i) The total power taken by the load (ii) The power consumed in the resistors if they are connected in delta to the same supply. (iii) If one of the resistors is open circuited, in each case calculate the power consumed. (10 Marks)

b) Explain the following with respect to a sinusoidal quantity (i) RMS value (ii) Average value (iii) Instantaneous value (iv) Form factor and (v) Peak factor. (10 Marks)

MODULE III

15. a) Explain the working principle of single phase induction motor. What are the different methods for starting single phase induction motors? Explain in detail. (10 Marks)

b) (i) Derive the EMF equation of a transformer (4 Marks)

(ii) A 125 KVA transformer having primary voltage of 2000V at 50 Hz has 182 primary and 40 secondary turns. Neglecting losses, calculate the full load primary and secondary currents, the no load secondary induced EMF, and maximum flux in the core (4 Marks)

(iii) Give four applications of DC shunt motor (2 Marks)

OR

16. a) Derive the EMF equation of DC generator. (5 Marks)

b) Explain the different characteristics of DC motor. (5 Marks)

c) Briefly explain about pipe earthing. (5 Marks)

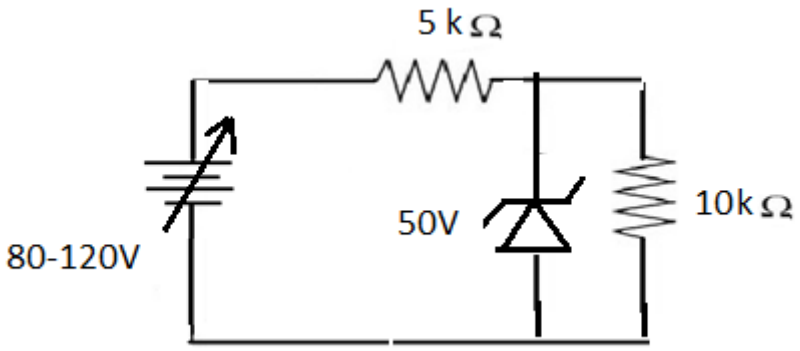
d) Explain the working of ELCB. (5 Marks)

MODULE IV

17. a) With neat diagram explain the working of common emitter amplifier. (5 Marks)

b) With neat block diagram explain the working of SMPS. (5 Marks)

c) For the given circuit, find the maximum value of zener diode current. (10 Marks)



OR

18. a) Explain the constructional details of enhancement type MOSFET (5 Marks)
    b) Explain the working of SCR (5 Marks)
    c) With a suitable diagram explain the solar cell (5 Marks)
    d) An AC supply of 230V is applied to a half wave rectifier circuit through a transformer of turns ratio 10:1 Find(i) the output DC voltage (ii) The PIV of the diode used. Assume diode to be ideal (5 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.108 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (FR)

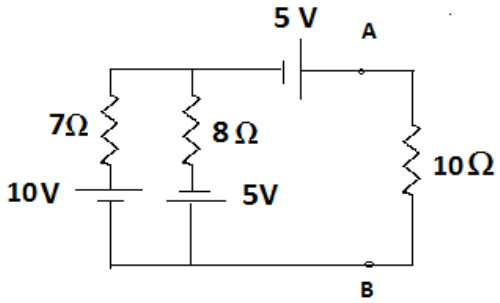
MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

PART A

*(Answer all questions. Each question carries **2** marks)*

1. Determine the current through 10 Ω resistor using Norton's theorem.



2. State and explain ohm's law.
3. Define RMS values and form factor of a sinusoidal voltage.
4. Three resistors R_1=20 Ω, R_2=90Ω and R_3=10 Ω are connected in star .Obtain the equivalent delta circuit.
5. Explain the advantages of three phase system over single phase system.
6. Explain the working principle of servo motor.
7. Define α and β for a transistor and derive the necessary relation between them.
8. Explain the action of shunt capacitive filters in a rectifier circuit.
9. Derive the EMF equation of a single phase transformer.
10. What are the applications of SCR.

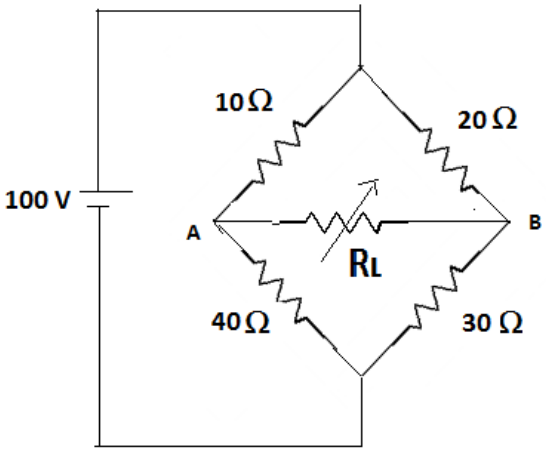
PART B

*Answer any one full question from each module. Each question carries **20** marks.*

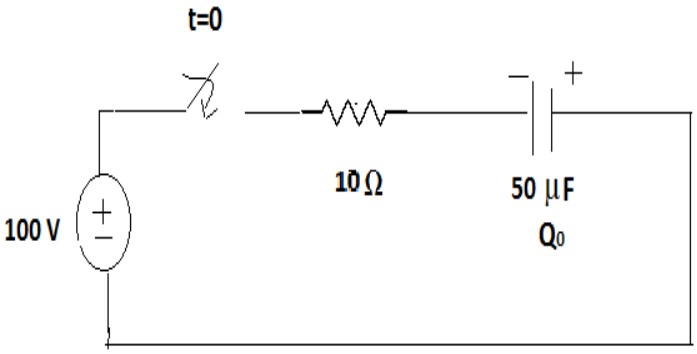
MODULE I

11. a) State and explain reciprocity theorem**.** **(**5 Marks)

b) Determine the load resistance so as to receive maximum power from the source. Also find maximum power delivered to the load in the circuit shown in figure given below. (7 Marks)



c) In a series R-C circuit shown in figure the capacitor has initial charge of 2.5mC. At t=0, the switch is closed and a constant voltage source V=100 volts is applied, find the current i(t) in the circuit applying Laplace transform. (8)



OR

12. a) A coil of resistance 5 Ω and inductance 1 mH is connected in series with a 0.2 μF capacitor. The circuit is connected to a 2.0 V variable frequency supply. Calculate i)the frequency at which resonance occurs , ii)the voltage across the coil and capacitor at this frequency and iii) the quality factor. (10 Marks)

b) Derive an expression to determine quality factor and bandwidth of a series resonant circuit. (10 Marks)

MODULE II

13. a) Express in rectangular notation the admittance of circuits having the following impedances i) (4+j6) Ω ii)$20\angle -30$ Ω . (5 Marks)

b) An alternating current flowing through a circuit has a maximum value of 70 A. and lags the applied voltage by 60 °. The maximum value of the voltage is 100 V, and both the current and voltage waveforms are sinusoidal. Plot the current and voltage waveforms in their correct relationship for the positive half of the voltage. What is the value of current when the voltage is at a positive peak. (8 Marks)

c) A mild steel ring of 30cm mean circumference has a cross sectional area of 6 cm and has a winding of 500 turns on it. The ring is cut in the winding through at a point so as to provide an air gap of 1mm in the magnetic circuit. It is found that a current of 4 A in the winding provides a flux density of 1 T in the air gap . Find (i) the relative permeability of mild steel (ii) inductance of winding. (7 Marks)

OR

14. a) Prove that the power in a 3-phase balanced circuit can be deduced from the reading of two Wattmeters. Draw the relevant connection and phasor diagrams .Discuss the nature of power factor

(i) when the two readings are equal and positive.

(ii) when the two readings are equal but opposite in sign.

(iii) when one of the wattmeter reads zero. (12 Marks)

b) A single phase motor operating of a 400V, 50 Hz supply is developing 10kW with an efficiency of 84% and a power factor of 0.7 lagging. Calculate i) input apparent power ii) active and reactive component current and iii) reactive power (in kilovars) (8 Marks)

MODULE III

15. a) Explain why single phase induction motor is not self starting. Explain any one method of starting **.** (8 Marks)

b) Describe the working and application of ELCB . (5 Marks)

c) With neat circuit explain the different types of dc generators. (7 Marks)

OR

16. a) Derive the condition for maximum efficiency of a transformer. Why transformer rating is specified in kVA**.** (10 Marks)

b) Explain the necessity of earthing. Describe with neat sketch **'** pipe earthing**'.** (10 Marks)

MODULE IV

17. a) With the help of block diagram explain how to produce a 9V dc power supply from 230V, 50Hz ac supply. (8 Marks)

    b) Write notes on the following

    i) LED

    ii) Photodiode

    iii) LCD

    iv) Solar cell (12 Marks)

OR

18. a) Design a voltage regulator circuit to have output voltage of 15 V when load current varies from 10 to 20 mA. Assume input voltage to be 20V and zener diode having zener voltage 15 V and I_{ZT} = 6mA**.** (7 Marks)

    b) Explain the construction and principle of operation of n-channel JFET. (7 Marks)

    c) In a half wave rectifier input signal is 110 V ,having frequency of 50Hz.Calculate Peak value of source voltage, Peak output voltage and DC load voltage assuming ideal diode (6 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.109 BASIC ELECTRONICS ENGINEERING (BCEHMNPSU)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

PART A

*(Answer all questions. Each question carries **2** marks)*

1. Name the two types of reverse breakdown which can occur in a pn junction diode. Which type occurs at lower voltage?
2. Explain the reason why the base current in a transistor is usually much smaller than I_E or I_C in active operation.
3. Implement the following logic functions using logic gates Y=AB+CD+AC.
4. A zener diode has an applied input volage of 32V. The series series resistance is of 1K and the zener voltage of 8.2V.Compute the zener current, neglecting the zener diode resistance.
5. What are the various coupling schemes of two stages of amplifier?
6. Explain why the resistance scale in a multimeter is zero at right end of the scale and reading increases towards left.
7. What are the factors that affect the radar range?
8. What is a satellite transponder? Draw its block diagram.
9. What are the features of WLL?
10. Describe the principle of communication through optical fiber.

(10x2=20 marks)

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) Explain the formation of the depletion region in an open circuit pn junction.
    b) Draw npn transistor in the CE configuration biased for operation in the active region. Draw its output characteristics and explain its shape.

OR

12. a) Draw typical drain characteristics of a JFET. Explain the shape of these curves qualitatively.

b) Draw the diagram of LED and explain its working.

MODULE II

13. a) Draw the block diagram of a regulated power supply. Explain in brief the functions of each block.

    b) With suitable diagram explain how you will measure temperature using thermistor.

OR

14. a) Explain with functional block diagram the working of a operational amplifier.

    b) Find the frequency of oscillation of an RC phase shift oscillator, if the feedback network consists of three sections, each comprising R = 2.7K and C = 0.001F

MODULE III

15. a) Draw the block diagram of AM high level modulation transmitter and explain its working.

    b) Explain the principle of operation of a pulsed radar.

    c) Compute the power in AM transmitted signal, if the carrier power is 100KW and the modulation Index is 60%.

OR

16. a) Draw the block diagram of an earth station transmitter and explain the functions of each block.

    b) Explain with block diagram the operation of a PCM system.

MODULE IV

17. a) Explain with block diagram the principle of operation of a mobile communication system.

    b) Describe the construction, characteristics and application of a APD.

OR

18. a) Explain the working of CCTV system with block diagram.

    b) Explain with block diagram the principle of operation of GPRS.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.109 BASIC ELECTRONICS ENGINEERING (BCEHMNPSU)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

PART A

*(Answer all questions. Each question carries **2** marks)*

1. In what respect is an LED different from an ordinary pn junction diode?
2. Define all the important parameters of a JFET.
3. Implement Y=AB+C using NAND gate and OR gate.
4. Explain why the Peak Inverse Voltage of a semiconductor diode is an important parameter.
5. State the condition under which a feed- back amplifier works as an oscillator.
6. How is dielectric loss of a dielectric material known using CRO?
7. What are the advantages of PCM over analog communication?
8. What is amplitude modulation? Define modulation index of an AM wave.
9. What are the features of CDMA?
10. Determine the wavelength of emission in the case of GaAs laser diode. The Eg of the diode is 1.43 eV.

(10x2=20 marks)

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) Compare the relative values of input and output resistances for CE, CB and BC configuration. Give their typical values.

    b) Explain the working of a solar cell with neat diagram.

OR

12. a) Draw the circuit diagram of the JK flip- flop and explain.

    b) Show the biasing arrangement of an n-channel JFET.

MODULE II

13. a) Draw the circuit diagram of a full wave rectifier using: (i) center tap connection (ii) bridge connection. Explain the working of each. What is the PIV in each case?

    b) Draw the circuit of a single stage transistor amplifier. State the function of each component used in this circuit.

OR

14. a) Draw the block diagram of an operational amplifier and explain the function of each block.

    b) With suitable block diagram explain the working of DSO.

MODULE III

15. a) Explain the working of a super heterodyne receiver with block diagram.

    b) Explain the principle of operation radar.

    c) Compute the modulation index, if the power in transmitted signal is120KW and the carrier power is 100KW.

OR

16. a) Draw the block diagram of earth station receiver and explain the function of each block.

    b) Explain with block diagram the operation of an ASK transmitter.

MODULE IV

17. a) Explain with block diagram the principle of operation of WLL.

    b) Describe the principle of light transmission through optical fiber.

    c) Compute the numerical aperture and acceptance angle, if n_1 =1.495 and n_2=1.485

OR

18. a) Explain the working of Semiconductor Laser with diagram. Mention the materials used in the fabrication of Laser.

    b) Draw the block diagram of cable TV system and explain.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.109 SEMICONDUCTOR DEVICES (AT)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

PART A

*(Answer all questions. Each question carries **2** marks)*

1. Discuss briefly how Miller Indices are determined.
2. For a GaAs semiconductor (Eg = 1.43 eV), determine the minimum wavelength of an incident photon that can interact with a valence electron and elevate to the conduction band.
3. Compute the number of holes in a heavily doped ($n = 1x10^{18}/cm^3$) n-type semiconductor material with intrinsic concentration $n_i = 1.5x10^{10}/cm^3$.
4. What is diffusion capacitance? Is it a capacitance that is always present in junctions?
5. Obtain the junction potential for $N_A = 1x10^{17}/cm^3$, $N_D = 1x10^{15}/cm^3$ and $n_0 = 1.5x10^{10}/cm^3$.
6. Draw the energy band diagram of a metal-n semiconductor junction under forward bias.
7. What is Gummel plot?
8. List the features of ideal MOS capacitor.
9. Explain hot electron effect.
10. Draw the equivalent circuit of UJT.

(10x2=20 marks)

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) What is the difference between density of states and effective density of states and why is the latter such a useful concept?

    b) An average hole drift velocity of 10^3 cm/s result when 2V is applied across a 1 cm long semiconductor bar. What is the hole mobility inside the bar?

OR

12. a) Define mobility of carrier. Explain the variation of mobility with temperature and doping.

b) A semiconductor sample has a donor concentration $N_D = 10^{15}/cm^3$ and minority carrier lifetime=$10x10^{-6}$ s. Compute the generation and recombination rate of electron hole pairs and the majority carrier lifetime.

MODULE II

13. a)Discuss the switching transients in a pn diode.

b) A Silicon p+n abrupt junction diode has doping concentration of $N_D=N_A= 1x10^{18}/cm^3$. Its critical breakdown electric field is 10^6 V/cm. Find the reverse breakdown voltage.

OR

14. a) Draw the energy band diagram of a metal semiconductor contact and explain its working.

b) A uniformly doped pn junction has $N_A=10^6/cm^3$, $N_D=5x10^{15}/cm^3$ and $V_{BI}=0.676$ V. Compute the temperature at which this occurs.

MODULE III

15. a) Describe the switching characteristics of a BJT.

b) Compute the base width required to achieve a base transport factor $\beta_T=0.95$. Given that $D_B=10cm^2/s$ and $\tau_B=10^{-7}s$.

OR

16. a) Derive a relation for the threshold voltage of a MOS capacitor.

b) Define the recombination factor and obtain an expression for it.

MODULE IV

17. a) Identify and explain the two modes of operation of the MOSFET.

b) An n-type MOSFET has W = 25μm, L = 2.5μm, t_{OX} = 400Å, $\mu_n = 800cm^2/Vs$ and $V_T=0.8V$. Compute the value of I_D for $V_{GS}=1$ V.

OR

18. a) Define the term population inversion. What conditions must be met for population inversion to occur?

b) A 0.3 μm single crystal of silicon is subjected to incident light normal to the surface having power of 20mW. Given the attenuation factor for silicon at the frequency of the light is $5x10^4$ cm^{-1} and the index of refraction of silicon is 3.5. Determine the power absorbed by the crystal.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.109 SEMICONDUCTOR DEVICES (AT)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

PART A

*(Answer all questions. Each question carries **2** marks)*

1. Draw the energy level diagram of an intrinsic semiconductor, n-type semiconductor and p-type semiconductor.
2. What are different carrier scattering mechanisms?
3. If the lattice constant or unit cell side length in Si is $a=5.43 \times 10^{-8}$ cm, what is the distance (d) from the centre of one Si atom to the centre of its nearest neighbour?
4. Discuss briefly the temperature dependence of diode V-I characteristics.
5. List the applications of Schottky-Barrier diode.
6. A Silicon p+n abrupt junction diode has a breakdown voltage of 20 V. Its critical breakdown electric field is 5×10^5 V/cm. Find the maximum n-type doping concentration.
7. What is base width modulation?
8. Explain the effect of real surface.
9. What is DIBL?
10. Discuss the merits and demerits of IGBT.

(10x2=20 marks)

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) Derive Einstein Relation.

    b) Determine the value of Hall electric field in the case of a Ge sample of length 0.1 cm, width of 0.01cm and thickness of 0.001cm, doped with 10^{17} acceptor atoms/cm^3. Assume that the current flowing through the sample is 5mA and the magnetic field applied is 1 μT.

OR

12. a) Derive the continuity equation.

b) Find the value of bandgap energy and *x* in the equation $GaAs_xP_{1-x}$. Given that for GaAs, E_g=1.43 eV and for GaP, E_g=2.43 eV and emitted radiation is 540 nm.

MODULE II

13. a) Discuss the construction and V-I characteristics of a Schottky diode.

    b) The forward current of a Silicon Schottky barrier diode and a pn junction diode are 1mA each. The reverse saturation currents of both the diodes are $10x10^{-7}$ A. Compute the value of the reverse saturation current of the pn junction diode if the difference in the forward voltages of the two diodes is 0.25 V.

OR

14. a) Explain the principle of heterojunction with band diagram. What are its applications?

    b) If the built in potential of a conventional GaAs pn junction diode is 0.64 V, find the depletion width, given that $N_D=1x10^{18}/cm^3$ and $N_A=1x10^{16}/cm^3$.

MODULE III

15. a) Describe the structure and working of the ideal MOS capacitor.

    b) Find the pinch off voltage of an n-type Silicon JFET having $N_D = 2 \times 10^{16}/cm^3$ and a = 2 μm.

OR

16. a) Draw the small signal equivalent circuit of the JFET. Define its device parameters and derive the relation connecting these parameters.

    b) Compute the value of the metal semiconductor work function difference in a MOS system whose V'_m=3.2 V, *X*'=3.25 V and $N_D=2x10^{16}/cm^3$.

MODULE IV

17. a) Describe the construction of IGBT with figure.

    b) An n-type MOSFET has t_{OX}=400 Å, μ_n=525 cm^2/Vs and V_T=0.75 V. Compute the value of W/L ratio if I_D=6mA for V_{GS}=2 V.

OR

18. a) Draw the structure of a solar cell and explain. Define the fill factor of solar cell.

    b) A Silicon solar cell 2cm x 2cm with I_{th}=32 nA has an optical generation rate of 10^{18} EHP/cm^2s. With $L_p = L_n$ = 2 μm of the junction. If the depletion width is 1μm, calculate the short circuit current and open circuit voltage for this cell.

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.109 FOUNDATIONS OF COMPUTING AND PROGRAMMING IN C (FR)

MODEL QUESTION PAPER – I

Time : **3 Hours** Maximum Marks : **100**

PART A

*(Answer all questions. Each question carries **2** marks)*

1. Define a digital computer.
2. How can you represent the integer 253 and the fraction 0.95 in the computer?
3. Compare assembler with compiler.
4. Discuss the concept of top down design strategy for problem solving with the help of an example.
5. Write an algorithm to find the larger between two numbers.
6. Write the equivalent while statement of the following for statement.

```
for(i=10;i≥1;i--)
{a=b;}
```

7. Define an array of structure for representing 10 complex numbers.
8. Illustrate the difference between static and dynamic memory allocation with the help of an example.
9. What do you mean by command line arguments? Give an example.
10. Differentiate between local variable and global variable.

(10 X 2 = 20Marks)

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) Discuss in detail the functional units of a digital computer with the help of a neat diagram**.** (10Marks)

b) Perform the following conversions.

a) $(1101011.01101)_2 = (\ ?\ )_{16}$

b) $(987.3A5)_{16} = (\ ?\ )_{10}$

c) $(7256.113)_8 = (\ ?\ )_2$

d) $(759.23)_{10} = (\ ?\ )_2$

e) $(21.35)_8 = (\ ?\ )_{16}$ (5X2=10 Marks)

OR

12. a) How can you represent floating point numbers in computers? Discuss normalization of floating point numbers. (4Marks)

b) Perform the required operations on the given numbers in normalized floating point mode.

i) x=0.101010101E0001010 and y=0.100010110E0000110 find x + y.

ii) x=0.101011001E0010110 and y=0.110000000E0000101 find x × y.

(6 Marks)

c) Perform the following arithmetic.

i) $(BC5)_{16}$ - $(A2B)_{16}$

ii) $(2567)_8 \div (6)_8$

iii) $(1010.010)_2$ - $(111.111)_2$

iv) 7.25 - 55.75 Using 9's complement method (10 Marks)

MODULE II

13. a) What is the need of high level programming language ? Explain the features of high level programming languages. (10 Marks)

b) Compare Highlevel language with assembly language. (5 Marks)

c) Define the term problem solving. Also discuss different steps in problem solving.

(5 Marks)

OR

14. a) Compare algorithm with flow chart. (5 Marks)

b) Write an algorithm to print Fibonacci series up to a given limit. (10 Marks)

c) Define the term debugging .Discuss different types of errors. (5 Marks)

MODULE III

15. a) Discuss various operators used in C. (10 Marks)

b) Write a C program to find the product of two matrices and print the result in column wise. (10 Marks)

OR

16. a) Compare linear search and binary search. (4 Marks)

b) Write a C program to perform selection sort. Perform selection sort on the given numbers: 39, 67, 10, 68, 30. (16 Marks)

MODULE IV

17. a) Write a C program to perform bubble sort using function. (10 Marks)

b) List various bitwise operators in C. (6 Marks)

c) Give the syntax of malloc() ,calloc() and realloc() functions. (4 Marks)

OR

18. a) Write a C function to implement stack using array. (10Marks)

b) Explain the concept of call by value and call by reference with the help of an example program. (10 Marks)

COMBINED FIRST AND SECOND SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)

13.109 FOUNDATIONS OF COMPUTING AND PROGRAMMING IN C (FR)

MODEL QUESTION PAPER – II

Time : **3 Hours** Maximum Marks : **100**

PART A

*(Answer all questions. Each question carries **2** marks)*

1. Discuss Von Neumann concept.
2. How can you represent the integer 25379 in BCD?
3. Discuss various types of memory in computer.
4. Define operating system and discuss its objectives.
5. Write an algorithm to find the average of n numbers.
6. Can you read two strings using a single scanf() function? Why?
7. Write any two differences between array and structure.
8. Give the syntax of union.
9. Differentiate between formal arguments and actual arguments.
10. Define a pointer and discuss its concept with the help of an example.

PART B

*Answer any one full question from each module. Each question carries **20** marks.*

MODULE I

11. a) Explain Von Neumann architecture with the help of a neat diagram. (10 Marks)

    b) Perform the following operations.

    i) $(259F.53)_{16} + (19B2.19)_{16}$

    ii) $(377.52)_8 \div (6)_8$

    iii) $(1001101)_2 \times (1101)_2$

    iv) $(8942)_{10} - (9599)_{10}$,using 10's complement method.

    v) $(23)_{10}-(67)_{10}$,using 2's complement method. (10 Marks)

OR

12. a) Define storage unit of a computer .Compare primary storage unit with secondary storage unit. (10 Marks)

b) Perform the required operations on the given numbers in normalized floating point mode.

i) x = 0.101010101E0001010 and y = 0.100010110E0000110 find x - y.

ii) x = 0.101011001E0010110 and y = 0.110000000E0000101 find x × y.

(4 Marks)

c) Discuss ASCII and EBCIDIC representations. (6 Marks)

MODULE II

13. a)Discuss the terms i)Compiler ii) Assembler iii)Interpreter (6 Marks)

b) Draw a flowchart for finding the positive, negative and zero numbers from a given set of values. (10Marks)

c) Discuss the concept of top down design strategy. (4 Marks)

OR

14. a) What is the need of high level programming language? Explain the features of high level programming languages. (10 Marks)

b) Draw a flowchart for finding the complete solution of a quadratic equation.

(10 Marks)

MODULE III

15. a) Write a C program to read a line of text,store it in array and then write it backwards.

(10 Marks)

b) With examples differentiate between structure and union. (10 Marks)

OR

16. a) Write a C program to read lines of text from a data file and display it on the screen. Also count the number of words in the text. (10 Marks)

b) Write a C program to perform searching for an element in an array of sorted elements. (10 Marks)

MODULE IV

17. a) Write a C function to implement queue using array. (10 Marks)

b) Discuss the use of command line arguments. (10 Marks)

OR

18. a) Define recursion .Write a recursive function to find the factorial of number and write a main program to calculate nCr. (10 Marks)

b) Write a C function to implement stack using array. (10 Marks)