Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: BE 100

Course Name: ENGINEERING MECHANICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions.

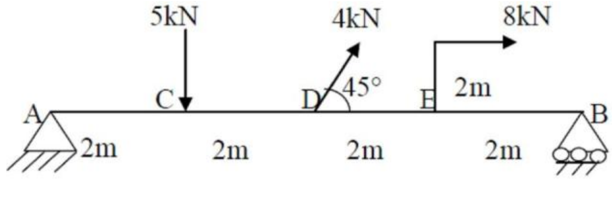
1	State and prove Varignon's theorem of moments.	(5)
2	A force acts at the origin in a direction defined by the angles $\Theta_y = 65^o$ and $\Theta z = 40^o$. The X component of the force is -90kN. Determine the other components of force and value Θx . Also find the magnitude of force.	(5)
3	A body weighing 150N is at rest on a horizontal plane. If a horizontal force of 108N will just cause it to slide, determine the limiting friction and coefficient of friction.	(5)
4	Define a) Radius of gyration b) Product of inertia c) Polar moment of inertia.	(5)
5	Explain the concept of instantaneous centre with figure.	(5)
6	Differentiate between free vibration and forced vibration of bodies.	(5)
7	State D'Alembert's principle. Write the equations of dynamic equilibrium for the motion of a lift moving upwards with an acceleration 'a' m/s^2 carrying a weight of 'W' N.	(5)
8	Determine the weight, which is to be connected to a spring of stiffness 5N/cm, so that the weight is oscillating with a time period of 1sec.	(5)

PART B

SET I

Answer any 2 questions.

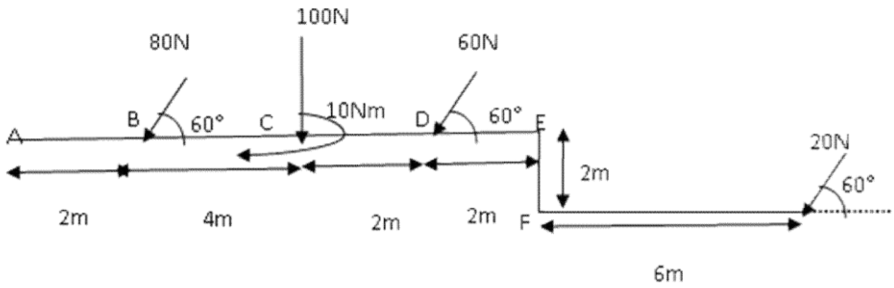
9	a)	Distinguish between a force and a couple. What are the characteristics of a couple?	(5)
	b)	Determine the support reactions at 'A' and 'B'.	(5)



10	A force P is directed from a point A (4,1,4) and a point B (-3,4,-1). If it causes a moment Mz = 1900Nm, determine the magnitude of force P and the moment of	(10)

this force about X and Y axes.

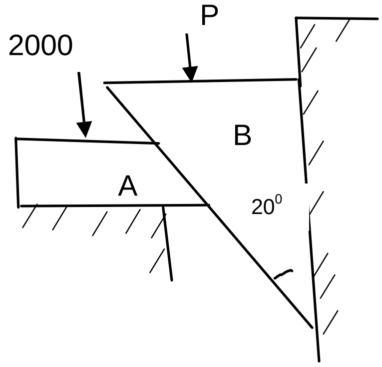
11 Find the magnitude, direction and position of the resultant. (10)



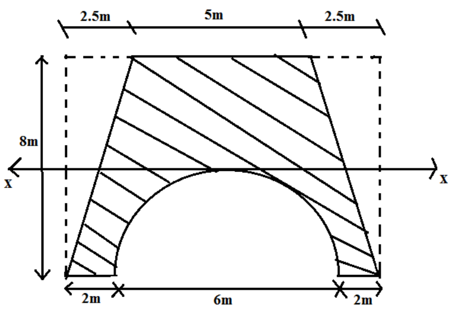
SET II

Answer any 2 questions.

12 Determine the vertical force P required to drive the wedge B downwards in the arrangement shown. The angle of friction is 12^0 at all rubbing faces. Angle of wedge is 20^0. (10)

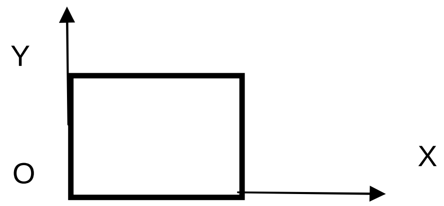


13 Find the centroid of the cross section of a culvert as shown in figure below. Determine the M. I of horizontal axis XX passing through top of the semi-circle. (10)



14 a) A body weighing 1000N rests on an inclined plane and is subjected to a horizontal force so as to keep it in equilibrium. If the angle of the plane is 30^0 and the angle of limiting friction is 10^0,find the least and greatest value of the force to keep the body in equilibrium. (6)

b) For 24mm length and12mm breadth rectangle, find moment of inertia about an axis inclined at 30^0 to OX axis. (4)



SET III

Answer any 2 questions.

15 A body of mass 4.5 kg is placed on a smooth table at a distance of 2 m from the edge. The body is connected by a light string passing over a smooth pulley. The other end of the string is connected with a body of mass 2.5 kg. Find
i) acceleration of the system and ii) time that elapses before the body reaches the edge of the table. (10)

16 a) A particle is moving with simple harmonic motion and performs 8 complete oscillations per minute. If the particle is 5 cm from the centre of the oscillation, determine the amplitude, the velocity of the particle and maximum acceleration. Given that the velocity of the particle at a distance of 7 m from the centre of oscillation is 0.6 times the maximum velocity. (8)

b) Explain the term ‘stiffness of a spring’. (2)

17 a) The length of connecting rod and crank in a reciprocating pump are 50 cm and 12 cm respectively. The crank is rotating at 300 rpm. Find the velocity with which the piston will move, when the crank has turned through an angle of 30^0 from the inner dead centre. (5)

b) Two springs of stiffness 4 kN/m and 6 kN/m are connected in series. Upper end of the compound spring is connected to a ceiling and lower end carries a block of mass 50 kg. The block is pulled 40 mm down from its position of equilibrium and then released. Determine the period of vibration, maximum velocity and acceleration of the block. (5)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: BE110

Course Name: ENGINEERING GRAPHICS

Max. Marks: 50 Duration: 3 Hours

PART A

Answer any two questions, each carries 10 marks. Marks

1 A line AB has its point A in HP and 30 mm in front of VP. Point B in VP and 60mm above HP. The distance between end projectors are 70 mm. Draw the projections and find true length of line and inclinations with HP and VP. (10)

2 The point A of a line is 40 mm above HP and 20 mm in front of VP. The point B is 30 mm below HP and 50 mm behind VP. The distance between end projectors is 100 mm. Find the true length of the line and its inclination with HP and VP. (10)

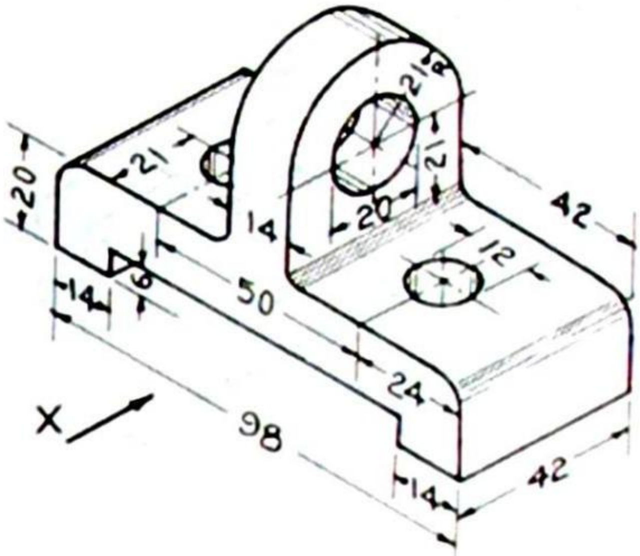
3 A pentagonal prism of base edge 30 mm and height 70 mm is resting on HP on its base edge such that the rectangular face containing that edge is inclined 45^{o} to HP and the base edge on which it is resting is inclined 30^{o} to VP (10)

PART B

Answer any three questions, each carries 10 marks.

4 Draw the isometric view of a right regular hexagonal prism of side of base 30mm and height 70mm resting on its base on HP , having a through circular hole of diameter 30mm drilled centrally through it along the axis. (10)

5 Figure shows the isometric view of a machine component with all the dimensions in mm. Draw its front view, top view and any one side view. Arrow (X) indicates the direction to obtain the view from the front. (10)



6 A cone of base diameter 60 mm and axis length 70 mm is resting on HP on its base. It is cut by a section plane which is perpendicular to VP and parallel to the right most generator in the front view, and section plane is 10 mm away from this generator. Draw the front view, sectional top view and true shape of the section. (10)

7	A pentagonal prism, having a base with a 30 mm side and a 70 mm long axis, is resting on its base on H.P. such that one of the rectangular faces is parallel to the V.P. it is cut by an auxiliary inclined plane making an angle 45^0 with the H.P. and passes through the midpoint of the axis. Draw the development of the lateral surface of the truncated prism.	(10)
8	A square prism of base side 35mm and axis length 65mm is resting on one of its rectangular faces on GP. The base nearer to PP is parallel to it and 15mm behind it. The station point is 50mm to the left of the axis of the prism, 55mm above the ground plane and 30mm in front of the picture plane. Draw the perspective view of the prism.	(10)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CY100

Course Name: ENGINEERING CHEMISTRY

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 2 marks. Marks

1 Which of the following molecules can give IR absorption spectrum? Write the condition for IR activity. (a) O_2 (b) H_2 (c) CO (d) CO_2 (2)

2 An iron nail is dipped in 1 M HCl, what are the redox reactions taking place? Justify it based on the following standard reduction potentials $2H^+ + 2e \rightarrow H_2$ $E^0 = 0$ V ; $Fe^{3+} + 3e \rightarrow Fe$ $E^0 = -0.04$ V; $Fe^{2+} + 2e \rightarrow Fe$ $E^0 = -0.44$ V (2)

3 Draw the thermo gram of Calcium oxalate. (2)

4 What are Copolymers? (2)

5 What are the advantages of liquid fuels over solid and gaseous fuels? (2)

6 What are semi solid lubricants? (2)

7 Dissolved oxygen of a water sample is inversely proportional to its temperature. Justify. (2)

8 In the determination of hardness of water by EDTA method NH_4OH-NH_4Cl buffer solution is used. Why? (2)

PART B

Answer all questions, each carries 3 marks.

9 A 100 ppm standard solution of Fe^{3+} after developing colour with excess ammonium thiocyanate solution shows a transmittance of 0.4 at 622 nm, while an unknown solution of Fe^{3+} after developing colour with excess ammonium thiocyanate solution shows a transmittance of 0.6 at same wave length. Calculate the concentration of Fe^{3+} in unknown solution. (3)

10 Calculate single electrode potential of calomel electrode at 25 ^oC when the concentration of KCl solution is 0.1M, given that E^0 standard calomel electrode = 0.2810 V. (3)

11 Differentiate TGA and DTA. (3)

12 How do you classify Nanomaterials based on dimensions? (3)

13		Explain what are solid lubricants with suitable examples?	(3)
14		Explain the preparation of Bio-diesel. What are the important constituents of Bio-diesel?	(3)
15		Plot a diagram of break point chlorination and What is its significance?	(3)
16		Calculate the carbonate and non carbonate hardness of a sample water containing 7.3 mg/L of $Mg(HCO_3)_2$, 40.5 mg/L of $Ca(HCO_3)_2$, 13.6 mg/L of $CaSO_4$.	(3)

PART C

Answer all questions, each carries 10 marks.

17	a)	What are the various types of electronic transitions in UV-visible spectroscopy?	(5)
	b)	Discuss the applications of IR spectroscopy.	(5)
		OR	
18	a)	What are the different types of NMR active nuclei? How many spin orientations are possible in a magnetic field when I= $^1/_2$ and I=1 give examples.	(5)
	b)	Explain the terms shielding and de-shielding in NMR spectroscopy.	(5)
19	a)	What are fuel cells? Explain the construction and working of $H_2 – O_2$ fuel cell.	(6)
	b)	What are the advantages and disadvantages of a fuel cell?	(4)
		OR	
20	a)	What are reference electrodes? Give examples for primary reference and secondary reference electrodes and give their electrode reactions.	(6)
	b)	Explain how single electrode potential of Zn electrode is determined?	(4)
21	a)	Write down the principle and instrumentation of DTA with a neat diagram.	(5)
	b)	Draw the DTA of calcium oxalate and explain the different reactions.	(5)
		OR	
22	a)	Explain the principle and classification of chromatography.	(5)
	b)	Write a note on column chromatography.	(5)
23	a)	Discuss the working of OLED with diagram. Give its two important advantages over conventional display devices.	(5)
	b)	How do you synthesise polyaniline, Give two properties and applications.	(5)
		OR	
24	a)	What are conducting polymers? Give the classification.	(5)
	b)	How will you dope a conducting polymer? Give the mechanism of conduction in doped polymer.	(5)

25		Write the working of Bomb calorimeter for the determination of calorific value of a solid fuel with the help of a neat diagram.	(10)
		OR	
26	a)	With the help of a neat labelled diagram, describe the fractional distillation of crude petroleum and name the various products obtained.	(5)
	b)	What are the major characteristics required for a good lubricating oil?	(5)
27	a)	Explain the working of trickling filter process with a neat labelled sketch.	(6)
	b)	How is exhausted resins regenerated in an ion-exchange method?	(4)
		OR	
28	a)	Explain reverse osmosis with a labelled figure and mention its advantages and disadvantages.	(6)
	b)	Discuss the ion-exchange process of softening of water.	(4)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER B.TECH DEGREE EXAMINATION,DECEMBER 2018

Course Code: MA101
Course Name: CALCULUS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks. Marks

1 a) Test the convergence of $\sum_{k=1}^{\infty}\frac{\cos k}{k^2}$ (2)

b) Discuss the convergence of $\sum_{k=1}^{\infty}\frac{(2k)!}{4^k}$ (3)

2 a) Find the slope of the surface $z = \sin(y^2 - 4x)$ in the $x -$ direction at the point $(3,1)$. (2)

b) Find the differential dz of the function $z = \tan^{-1}(x^2y)$. (3)

3 a) Find the direction in which the function $f(x,y) = xe^y$ decreases fastest at the point $(2,0)$. (2)

b) Find the tangent plane to the elliptic paraboloid $z = 2x^2 + y^2$ at $(1,1,3)$ (3)

4 a) Evaluate $\iint_R y\sin xy\ dA$, where $\boldsymbol{R} = [1,2] \times [0,\pi]$. (2)

b) Evaluate $\int_0^2\int_0^1 \frac{x}{(1+xy)^2}$ dy dx (3)

5 a) if $\vec{A} = (3x^2 + 6y)\boldsymbol{i} - 14yz\boldsymbol{j} + 20xz^2\boldsymbol{k}$,evaluate $\int \vec{A}.d\vec{r}$ from (0,0,0) to(1,1,1) along the path,$x = t, y = t^2, z = t^3$ (2)

b) Prove that $\vec{F}=(x^2 - yz)\boldsymbol{i} + (y^2 - xz)\boldsymbol{j} + (z^2 - xy)\boldsymbol{k}$ is irrotational. (3)

6 a) Determine the source and sink of the vector field (2)

$\boldsymbol{F}(x,y,z) = 2(x^3 - 2x)\boldsymbol{i} + 2(y^3 - 2y)\boldsymbol{j} + 2(z^3 - 2z)\boldsymbol{k}$

b) Evaluate $\iint_S \bar{F}.\bar{n}ds$ where S is the surface of the cylinder $x^2 + y^2 = 4$, $z = 0$, $z = 3$ where $\bar{F} = (2x - y)\bar{\imath} + (2y - z)\bar{\jmath} + z^2\bar{k}$ (3)

PART B

Module 1

Answer any two questions, each carries 5 marks.

7 Check the convergence of the series $\frac{3}{4} + \frac{3.4}{4.6} + \frac{3.4.5}{4.6.8} + \frac{3.4.5.6}{4.6.8.10} + \cdots$ (5)

8 Find the radius of convergence of the power series $\sum_{k=1}^{\infty}\frac{(-1)^k(x-4)^k}{3^k}$ (5)

9 Determine whether the alternating series $\sum_{k=1}^{\infty}(-1)^{k+1}\frac{3^{2k-1}}{k^2+1}$ is absolutely (5)

convergent.

Module 1I

Answer any two questions, each carries 5 marks.

10 If $u = x^2 tan^{-1}\left(\frac{y}{x}\right) - y^2 tan^{-1}\left(\frac{x}{y}\right)$, find $\frac{\partial^2 u}{\partial x \partial y}$ (5)

11 Let $z = xye^{\frac{x}{y}}, x = r\ cos\theta,\ y = r\ sin\theta$, use chain rule to evaluate $\frac{\partial z}{\partial r}$ and $\frac{\partial z}{\partial \theta}$ at $r = 2$ and $\theta = \frac{\pi}{6}$ (5)

12 A rectangular box open at the top is to have volume $32m^3$. Find the dimensions of the box requiring least material for its construction. (5)

Module III

Answer any two questions, each carries 5 marks.

13 Suppose that a particle moves along a circular helix in 3-space so that its position vector at time **t** is **r**(t) = $4\cos\pi t\ \mathbf{i} + 4\ \sin\pi t\ \mathbf{j} + t\ \mathbf{k}$. Find the distance travelled and the displacement of the particle during the time interval $1 \le t \le 5$. (5)

14 Suppose that the position vector of a particle moving in a plane $\bar{r} = 12\sqrt{t}\ \boldsymbol{i} + t^{\frac{3}{2}}\boldsymbol{j}, t > 0$. Find the minimum speed of the particle and locate when it has minimum speed? (5)

15 Find the parametric equation of the tangent line to the curve $x = \cos t, y = \sin t, z = t$ where t = t_0 and use this result to find the parametric equation of the tangent line to the point where t = π. (5)

Module 1V

Answer any two questions, each carries 5 marks.

16 Evaluate where R is the region in the first quadrant enclosed between the circle and the line $x + y = 5$. (5)

17 $$Evaluate \int_1^2 \int_0^x \frac{dy\,dx}{x^2 + y^2}$$ (5)

18 Evaluate $\iiint_V xdxdydz$ where V is the volume of the tetrahedron bounded by the plane $x = 0, y = 0, z = 0\ x + y + z = a.$ (5)

Module V

Answer any three questions, each carries 5 marks.

19 Find the scalar potential of $\vec{F} = (2xy + z^{3})\boldsymbol{i} + x^2\boldsymbol{j} + 3xz^2\ \boldsymbol{k}$ (5)

20 Find the work done by $F(x, y) = (x^2 + y^2)\boldsymbol{i} - x\boldsymbol{j}$ along the curve $C: x^2 + y^2 = 1$ counter clockwise from $(1,0)$ to $(0,1)$. (5)

21 Evaluate $\int_C \bar{F} \cdot d\bar{r}$ where $\bar{F} = y^2\mathbf{i} + xy\,\mathbf{j}$ and $\bar{r}(t) = t\mathbf{i} + 2t\mathbf{j}$, $1 \le t \le 3$. (5)

22 Evaluate $\int \; y\,dx + z\,dy + x\,dz$ along the path $x = \cos \pi t, y = \sin \pi t\,,\; z = t$ from $(1,0,0)$ to $(-1,0,1)$ (5)

23 If $\bar{r} = x\,\bar{\imath} + y\,\bar{\jmath} + z\,\bar{k}$ and $= \|\bar{r}\|$, prove that $\nabla^2 f(r) = \frac{2}{r} f'(r) + f''(r)$. (5)

Module VI

Answer any three questions, each carries 5 marks.

24 Using Stoke's theorem evaluate $\int_C \overline{F} \cdot d\bar{r}$; where $\bar{F} = xy\,\bar{\imath} + yz\,\bar{\jmath} + xz\,\bar{k}$; C triangular path in the plane $x + y + z = 1$ with vertices at $(1,0,0), (0,1,0)$ and $(0,0,1)$ in the first octant (5)

25 Using Green's theorem evaluate $\int_C (y^2 - 7y)dx + (2xy + 2x)\,dy$ where C is the circle $x^2 + y^2 = 1$ (5)

26 Find the mass of the lamina that is the portion of the cone $z = \sqrt{x^2 + y^2}$ between $z = 1$ and $z = 3$ if the density is $\emptyset(x, y, z) = x^2 z$. (5)

27 Use divergence theorem to find the outward flux of the vector field $F(x, y, z) = x^3 i + y^3 j + z^3 k$ across the surface σ bounded by $x^2 + y^2 = 4,\; z = 0$ and $z = 4$. (5)

28 If S is the surface of the sphere $x^2 + y^2 + z^2 = 1$,Evaluate (5)

$$\iint_s (xi + 2yj + 3zk) \cdot dS$$

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Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: MA102

Course Name: DIFFERENTIAL EQUATIONS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks

1	Find a general solution of the ordinary differential equation $y^{uu} + y = 0$	(3)
2	Find the Wronskian of $e^s \cos 2x$ and e^s si n2x	(3)
3	Find the particular integral of the differential equation $y^{uu} + y = \cos h5x$	(3)
4	Using a suitable transformation, convert the differential equation. $(3x + 2)^2 y^{uuu} + 5(3x + 2)y^{u} - 3y = x^2 + x + 1$ into a linear differential equation with constant coefficients.	(3)
5	If $f(x)$ is a periodic function of period 2L defined in $[-L, L]$. Write down Euler's Formulas a_O, a_n, b_n for $f(x)$.	(3)
6	Find the Fourier cosine series of $f(x) = x^2$ in $0<x\leq c$.	(3)
7	Find the partial differential equation of all spheres of fixed radius having their centres in xy-plane.	(3)
8	Find the particular integral of r + s - 2t $= f\overline{2x + y.}$	(3)
9	Write any three assumptions involved in the derivation of one dimensional wave equation.	(3)
10	Solve $x \frac{6u}{6s} - 2y \frac{6u}{6y} = 0$ using method of separation of variables.	(3)
11	Find the steady state temperature distribution in a rod of 30 cm having its ends at 20^0C and 80^0C respectively.	(3)
12	Write down the possible solutions of the one dimensional heat equation.	(3)

PART B

Answer six questions, one full question from each module

Module 1

13	a)	Solve the initial value problem $y^{uu} + 4y^{u} + 5y = 0, y(0) = 2, y^{u}(0) = -5.$	(5)
	b)	Find a basis of solutions of the ODE $(x^2 - x)y^{uu} - xy^{u} + y = 0$, if y_1= x is a	(6)

solution.

OR

14 a) Reduce to first order and solve $y'' + (1 + \frac{1}{y})(y')^2 = 0$ (5)

b) Solve the initial value problem $9y'' - 30y' + 25y = 0, y(0) = 3, y'(0) = 10$. (6)

Module 1I

15 a) Solve $y'' - 2y' + 5y = e^{2x}\sin x$. (5)

b) Using method variation of parameters solve $y'' + 4y = \tan 2x$ (6)

OR

16 a) Solve $x^3y''' + 3x^2y'' + xy' + y = x + \log x$ (5)

b) Solve using method of variation of parameters $y'' - 2y' + y = \frac{e^x}{x}$ (6)

Module 1II

17 Find the Fourier series of periodic function $f(x) = \begin{cases} -x, & -1 \le x \le 0 \\ x, & 0 \le x \le 1 \end{cases}$ with period 2. Hence prove that $1 + \frac{1}{3^2} + \frac{1}{5^2} + \cdots \ldots = \frac{\pi^2}{8}$. (11)

OR

18 Find the Fourier series of periodic function $f(x) = x\sin x$, $0 < x < 2\pi$ with period 2π. (11)

Module 1V

19 a) Solve $p - 2q = 3x^2 \sin(y+2x)$. (5)

b) Solve $r + s - 6t = y \sin x$. (6)

OR

20 a) Solve $x(y - z)p + y(z - x)q = z(x - y)$. (5)

b) Solve $(D^2 - 2DD' - 15D'^2)\, z = 12xy$. (6)

Module V

21 A tightly stretched string of length L is fixed at both ends. Find the displacement u(x,t) if the string is given an initial displacement f(x) and an initial velocity g(x). (10)

OR

22 A tightly stretched string with fixed end points x = 0 and x = l is initially in a position given by $u = v_0\sin^3\left(\frac{\pi x}{l}\right)$, $0 \le x \le l$. If it is released from rest from this position, find the displacement function u(x, t) (10)

Module VI

23 The ends A and B of a rod of length L are maintained at temperatures 0^0C and 100^0C respectively until steady state conditions prevails. Suddenly the temperature at the end A is increased to 20^0C and the end B is decreased to 60^0C. Find the temperature distribution in the rod at time t. (10)

OR

24 Find the temperature distribution in a rod of length 2 m whose end points are maintained at temperature zero and the initial temperature is (10)

$f(x) = 100(2x-x^2), 0 \le x \le 2$

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Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: PH100

Course Name: ENGINEERING PHYSICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 2 marks. Marks

1	What do you understand by Quality factor? On what factors does it depend?	(2)
2	Write down equation that represents a wave having amplitude 5cm, period 0.002 sec and velocity 1500m/s that moves along **–x** axis.	(2)
3	Why is the centre of Newton's rings pattern dark in reflected system?	(2)
4	What do you mean by resolving power of an optical instrument?	(2)
5	Define Plane of Vibration and Plane of Polarization.	(2)
6	Why a superconductor is called a perfect diamagnet?	(2)
7	What are the characteristics of a well-defined wave function?	(2)
8	Find the smallest volume of a unit cell in phase space for a particle obeying quantum statistics.	(2)
9	What is absorption coefficient?	(2)
10	What is SONAR? Give one use of it.	(2)
11	Distinguish between spontaneous emission and stimulated emission.	(2)
12	What is a photo-detector? Give two examples.	(2)

PART B

Answer any 10 questions, each carries 4 marks.

13	What is the condition for critical damping in the case of a damped harmonic oscillator? With the help of the expression for displacement write how this condition affects the amplitude of the oscillator?	(4)
14	The string of violin **36 cm** long and has a mass of **0.2gm**. With what tension it must be stretched to tune **1000 Hz**.	(4)
15	In a Newton's ring arrangement, if a drop of water (**μ = 4/3**) is placed in between lens and the plate, the diameter of the **10^{th}** dark ring is found to be **0.6 cm**. Obtain the radius of curvature of the face of the lens in contact with the plate. The wavelength of light used is **6000Å**.	(4)
16	Compare grating and prism spectra.	(4)
17	A plane polarised light is incident on a piece of quartz and parallel to the axis. Find the least thickness for which the ordinary and extra-ordinary rays combine to form plane polarized light. Given that the refractive indices for the ordinary and extra-ordinary rays are **1.5442** and **1.5533** respectively and wavelength of	(4)

light is **500nm**.

18 Briefly explain the BCS theory of superconductivity. (4)

19 Obtain energy and momentum operators. (4)

20 State the postulates of Bose-Einstein statistics. (4)

21 The volume of a hall is **3000 m^3**. It has a total absorption of **100 m^2Sabine**. If the hall is filled with audience who add another **80m^2Sabine**, find the difference in reverberation time. (4)

22 Calculate the thickness of quartz crystal required to produce ultrasonic waves of frequency **1 MHz**. Young's modulus and density of quartz are **8 x 10^{10} N/m^2** and **2650 kg/m^3** respectively. (4)

23 What is resonant cavity? What is its importance in the production of laser light? (4)

24 What is an LED? Give its working principle. What are the main uses of it? (4)

PART C

Answer any three questions, each carries 6 marks.

25 Frame the differential equation of a forced harmonic oscillator and obtain its solution. (6)

26 Derive cosine law and explain colours in thin films in reflected light (6)

27 Distinguish between Type I and Type II superconductors citing examples. Explain the formation of Cooper pairs according to BCS theory. (6)

28 State Uncertainity principle. Explain the absence of electron inside the nucleus using this principle. (6)

PART D

Answer any three questions, each carries 6 marks.

29 Write any six factors affecting acoustics of buildings and their remedies. (6)

30 What are ultrasonic waves? What is NDT? Explain how the ultrasonic pulse technique is used for non-destructive testing of materials. (6)

31 With a neat figure and energy level diagrams, explain the construction and working of a Helium-Neon laser. (6)

32 With a neat diagram derive an expression for numerical aperture. Give any four applications of optical fibre. (6)

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