

In Test: Nine Notebooks

THE LIGHT HEAVYWEIGHTS

With path-breaking technologies like the mobile Pentium II and DVD-ROM drives making a presence in notebooks, the line between these road warriors and conventional desktops is becoming increasingly thin...



You can buy a brand-new notebook for as low as Rs 60,000! Today, when you think of a notebook computer, you need not think of the heavy price tag that placed notebooks out of reach for most of us. Notebooks have become affordable and address a cross-section of users ranging from students to power users. Notebooks for the demanding user are armed with a mobile Pentium II processor, large 15-inch TFT (See Glossary) displays, integrated AGP graphics, a DVD-ROM drive, 56K data/fax, 8 GB hard disks and a plethora of other features.

With so much power available today, notebook computers are finally a viable option for users who

need serious computing power and functionality when on the move.

In a tight squeeze

What really does go into the making of these portable wonders? How do manufacturers manage to pack so much computing power into such a small space? The answers lie in newer and improved fabrication processes that are aimed at reducing the size of the components, as well as in more efficient and low-voltage processors. As technology evolves, the notebooks run faster than their predecessors.

The components of a notebook are very similar to those used in their bigger brothers, the

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desktops. Only these components are specially fabricated to withstand the strains that they may be subjected to during their life on the road. For example, the hard disk drives used in many notebooks, are specially encased in a protective gel that protects it from damage due to physical shocks like dropping and rough usage. The shells of notebooks are constructed of special magnesium alloys making them very resilient to scratches and rugged use.

The components are such that they conserve as much space and weight as possible. For example, the RAM used in these computers, called SODIMM (Slim Outline Dual Inline Memory Modules) is smaller and thinner. The batteries are almost exclusively the lithium-ion type. These are capable of greater storage capabilities in a smaller package and have a longer life than the older Nickel Cadmium type. Again, the component layout is such that there is as much packed into a notebook as is physically possible.



The internals—thin is in

Components (See picture) that constitute a notebook are:

1. Expansion bus: Various types of devices (fax/modems, soundcards, network cards and other peripherals) can be added to a notebook through special slots, known as PCMCIA (Personal Computer Memory Card Industry Association) slots. In the initial stages, PCMCIA cards were only a means of implementing solid-state data storage. Now, however, they have expanded to accommodate I/O cards which is how most of PCMCIA cards are categorised.

Two standards are used for these

cards: PCMCIA 1.0 which employs thinner cards and PCMCIA 2.0, in which the cards conform to a thicker form factor. Apart from the difference in physical dimensions and pin-outs, PCMCIA 2.0 cards also specify the file formats and data structures (software, through which the card notifies the host about its capabilities and functions).

2. Keyboard: Most notebook computers come equipped with full-size keyboards. A membrane separates the

keys from the contacts underneath and makes the keyboards, resilient to liquids spilling on them. The most important factor in a keyboard is the feel and the spacing of the keys—they should be as natural as possible and should not pose a strain during prolonged usage.

3. Pointing device: Notebooks incorporate a variety of pointing devices. Some notebooks feature a small joystick-like device that is located between two keys. The cursor moves in the direction of application of pressure to this device. Though difficult to get used to, this device is preferred by some users and is seen in the IBM ThinkPad series of notebooks. In older

notebooks, cursor control was effected through the use of a trackball. This pointing method is simple, but like any other mouse requires regular cleaning. Most common in today's notebook computers is a touchpad, which is a touch-sensitive plate located near the keyboard, where the user can control the cursor by moving a finger over the sensitive area. To double-click one has to simply tap the touchpad. The choice of pointing device is solely dependent upon users, though most seem to find the touchpad the most convenient.

4. Display: Notebook displays account for 70 percent of the total cost. The newest notebooks available use a technology called 'Active Matrix' to deliver crisp, vivid images and allow a wide viewing angle as opposed to the older Dual-scan passive matrix technology. The sizes available are 12.1-inch, 13.3-inch, and 15.1-inch.

5. Memory: The RAM modules, called SO-DIMM (Slim Out-

line—Dual Inline Memory Modules) are of a different form factor as those used in desktop systems. The fastest RAM available for notebook computers are SDRAM, but lower cost notebooks carrying EDO-RAM are also available. Older DRAMs are practically obsolete and are rarely found in notebooks available today.

6. Hard disk: This category has seen a massive evolution since the first notebook. High-end portable systems that have hard disk capacities of over 8 GB are available, while most usually feature a 4.1 GB hard disk. All these hard disks are IDE and are constructed with a smaller form

factor than the conventional 3.5-inch drives used in desktops.

7. Battery: All but the lowest range of notebook computers feature Lithium-Ion cells. Depending upon your usage patterns and the applications, battery life can be anything between 2 and 4 hours. Some newer notebooks also have the option of longer-life batteries that can last for up to six hours.

What to look for in a notebook

Before investing in a notebook, consider the application it is going to be used for.

Students who require one for tasks such as document writing and Internet surfing, should opt for a 233 MHz-based system with an integrated (or PCMCIA) modem—this configuration serves the purpose and is not overly expensive. Executive or businessmen should add a PCMCIA LAN card to the above notebook so as to effect connectivity with the office network. It would also be advantageous to buy a laptop with a TFT screen if you make a lot of presentations on the road.

Software developers, researchers and graphics artists need a sufficiently

powerful laptop. Today, with processors like the Pentium II and the AMD K6-2 available in mobile versions, there is a considerable amount of processing power at your disposal. For such applications, the largest possible hard disk (preferably 8 GB), plenty of RAM (128 MB) and integrated AGP graphics are a must. However, the cost of such machines can be anywhere upwards of Rs 125,000 depending upon the configuration.

Those who use the notebook extensively on the road should buy one that features an integrated power supply. Otherwise it becomes necessary to carry a separate power adapter adding to the overall weight of the notebook.

If you are not too particular about a very high performance display, choose a notebook with a DSTN screen. These are less expensive than TFT displays.

Prefer a notebook with a CD-ROM drive. Virtually all software is supplied on CD-ROM and the last thing you want to do when on the move, is to carry an external CD-ROM drive.

Choose a notebook that allows a CDROM drive and a floppy disk drive to be used simultaneously. These are

more convenient.

On the ergonomical side, if you are used to typing and using the touchpad simultaneously, choose a notebook that has the touchpad located exactly below the spacebar. This layout places the touchpad at the centre of the keyboard (See illustration on previous page) and facilitates usage.

A new lease on Power—the mobile Pentium II...

With the introduction of newer and more powerful hardware, mobile computing is undergoing a dramatic change. Many performance devices that have been associated with high-end desktop systems, like AGP graphics and DVD-ROM drives, have begun to make an appearance in many notebook computers. One such device that has changed the face of mobile computing is the Mobile Pentium II processor.

The Mobile Pentium II processor combines the power of the Pentium II with the benefit of consuming significantly lesser power than the desktop version. These processors incorporate state-of-the-art technologies, such as Intel's 0.25 micron manufacturing process. This innovative process makes

GLOSSARY

Cardbus: In early 1995, PCMCIA introduced the 32-bit CardBus standard. Although electrically different the CardBus is architecturally identical to the PCI bus. The CardBus supports bus mastering and accommodates cards operating at different voltages. Its advanced power management features allows the computer to take advantage of CardBus cards designed to idle or turn off in order to increase battery life. The CardBus specification allows data transfer up to 132 Mbps over a 33MHz, 32-bit data path.

Docking Station: This is a device into which the notebook computer interfaces, so as to connect to other devices. Through a docking station, the notebook can exchange data between itself and a desktop computer and can make use of the additional ports. Some docking stations incorporate a CDROM or DVD drive, which are purposely left out of very thin and light sub-notebook computers.

DSTN: (Dual-scan STN) is an enhanced STN passive matrix LCD display. The screen is divided into halves and each half is scanned simultaneously, thereby doubling the number of lines refreshed per second and providing a sharper display. DSTN is widely used in the lower price range laptops.

Hibernation: This mode conserves power by sending all power-saving devices into suspend state.

Lithium-Ion battery: This is a rechargeable battery technology that provides more than twice the charge per pound as nickel metal hydride (NiMH batteries). Although used in devices such as camcorders and other portable electronic equipment, Toshiba introduced the first lithium ion notebook in the US in 1993.

SO-DIMM: Slim Outline Dual In-Line Memory Modules is very similar to the DIMM modules used in desktop computers. The only difference is in the size, they

are smaller so as to be accommodated in notebooks.

TFT: (Thin Film Transistor) Refers to active matrix screens on laptop computers. Active matrix LCD provides a sharper display and broader viewing angle than a passive matrix.

Trackpoint: The pointing stick introduced and popularised by IBM on its ThinkPad laptops. This pointing device is now used by a variety of other notebook computer companies.

Zoomed Video (ZV-)Port: An extension to the PC Card (PCMCIA) standard, this provides a high transfer rate for video applications on portable computers. Video data goes directly to the display controller, bypassing the CPU and system bus, allowing full-screen, full-motion playback of digital video. The ZV Port is built into the notebook computer and activated by plugging in an MPEG PC Card that is ZV Port-compliant.



Touchpad off-centre with respect to keyboard



Touchpad in the centre with respect to keyboard

it possible for these CPUs to include up to 27 million transistors in the processor core, resulting in more power in less space.

The newest mobile PII processors are available in 366 MHz versions with 256 KB of on-board L2 cache. These processors are rated to have performance gains of up to 26-47 percent over the 266 MHz mobile PII. The 256 KB of cache is half of that present on the desktop versions, but offers three times the access rates and more efficient power consumption. To fit into mobile PCs of various sizes, weights, and price range, mobile Pentium II processors are available in Mini-Cartridge, MMC1, MMC2, and now in the new package called the BGA package. The BGA package is 60 percent smaller than the Mini-Cartridge and half its height.

These processors incorporate a new energy saving device called Quick

Start. With Quick Start, the processor works at a lower wattage when the system sits idle, such as when you pause to think or review information. This results in increased processing capabilities for more demanding business applications, without sacrificing battery life.

Like their desktop counterparts, mobile Pentium II processors combine three innovative data-processing techniques to manipulate data more intelligently and efficiently. These techniques predict and analyse software instructions to optimise processor workload. Mobile Pentium II processors are built to conform to Intel's WfM (Wired for Management) initiative. This allows the processors to benefit from features such as self-testing circuitry, advanced power management, and instrumentation for system monitoring.

NOTEBOOK SALES TRENDS IN INDIA

In 1997-98, the notebook market grew by a sizeable 60 percent over the previous year. Shipments of notebooks amounted to over 25,000 units which was 19 percent higher than that achieved in the year before that. There has also been a fall in the average cost of a notebook in India as compared to the 1996-97's average price of US \$2,830.

Compaq with its Armada range is the current favourite. The rise in company's performance is significant, considering that it was placed well behind IBM as well as Wipro Acer since the previous year. Compaq had a strategy of focussing all resources on a few models within a price range where the volumes were, and this approach paid off handsomely. While IBM sold about 400 units more than in the previous year, the sales of Wipro-Acer have declined.

In terms of value, IBM continues to be the leader

with US \$13.6 million compared to US \$11.42 grossed by Compaq. Toshiba follows Compaq in the third position. The top 5 notebook manufacturers also include Acer and Digital. They contributed 50 percent of the overall market share in unit shipments and 61 percent in terms of value. It is evident that the notebook market is controlled by a few vendors as against the top ten in the desktop market.

The increase is not only in terms of numbers, the penetration of portables has also gone up and the average selling price has come down. However, the utopian situation of a notebook for the common man is still a dream. Notebooks are almost twice as expensive as a desktop. This is the paradox facing the portables segment. In tight market conditions and a price sensitive market like India, users are likely to lean in the favour of desktops.

TEST PROCESS

The notebooks were subjected to an array of tests to evaluate their performance in a variety of applications. The test procedure used was similar to the one used in testing desktop systems, with the addition of evaluating the battery performance.

Prior to launching the test software, the systems were normalised in order to place them all on a level playing field. All programs were removed from the startup group as well as from the registry (HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run). This eliminated the execution of any TSRs and other programs like virus scanners and scheduling programs that would hamper the performance and accuracy of the tests. The display resolution was set to 800 x 600, 16-bit colour, small fonts and the hardware was verified to be correctly configured.

The primary benchmarking software was the Ziff-Davis Winbench® 99 Version 1.0. This software consisted of a suite of programs—Word processing, Image editing, CPU performance and the battery life. The programs used to test the various sub-systems are Disk Winmark, Graphics Winmark, CPUmark32, FrontPage 98, Photoshop 4.0, Premiere 4.2 and a program called Lptest developed by the International CHIP Test Centre at Munich.

The Lptest is a DOS-based program that constantly accesses the hard disk drive and creates a minute-wise log of the transfer rate of the hard disk. The test goes on till the battery is completely drained and the notebook switches itself off. Before running this test, the accumulator is conditioned, that is, it is charged completely and all the power saving features are disabled from the CMOS to provide a true indication of the quality and the power storing capability of the battery.

Winbench® is a registered trademark or trademark of ZD Inc. in the U.S. and other countries.

Acer Extensa 501DX The Lucciano of laptops



- + Excellent multimedia capabilities
- + Independent CD controls

Processor: 266MMX
HDD: 3.2 GB
RAM: 32 MB
Display: 12.1-inch TFT
Price: Rs 99,950 + taxes
Dealer: CompuSoft
Phone: 022-6483134
Fax: 022-6053176

The Extensa is a feature-rich notebook with sufficiently powerful multimedia capability. The 266 MHz MMX Pentium is perfect for tasks that are not too power-hungry, while the 20X CD-ROM drive and integrated 16-bit sound teamed with two very impressive speakers provide sound that is surprisingly sharp and defined for a notebook computer. The speakers are front mounted and the construction is such that they provide even, sharp and sufficiently loud sound.

The 3.2 GB hard disk and 32 MB of memory put it in the middle range of notebooks. This was the only notebook besides the IBM ThinkPad that featured independent control of the CD-ROM drive. This allows the drive to be used as a conventional audio CD player without having to switch the computer 'on'. Play, pause, fast forward and rewind and other controls

are integrated on this control panel—all these features make the notebook very convenient for those who listen to audio CDs often, since they do not need to do so through software.

The 12.1-inch TFT display was sharp and did not display any blurring in fast moving images. The S3 Virge graphics card complemented the display adequately, but was not good for very complex graphical applications. Standard accessories include the carry case, an instruction and users manual and a power adapter.

The multimedia capabilities of this machine make it very suitable for users like executives and businessmen who frequently make presentations while on the road. The powerful and clear sound provided by the audio sub-system makes it ideal for areas where external amplification is not present.

ACi Emerald Excellent price-worthiness



- + Good balance between price and features
- + Large Display

Processor: AMD K6-2 300
HDD: 4 GB
RAM: 32 MB
Display: 13.1-inch TFT
Price: Rs 79,990
Dealer: ACi-India
Phone: 022-3683644
Fax: 022-3683645

New in the Indian notebook market, ACi is a UK-based company with an impressive range of highly customisable portable computers. The Emerald falls in the entry level of its range. Since the computers manufactured by ACi are configured according to individual specifications, the various components of the Emerald can be tailor-made to the buyer's needs. The notebook tested at the CHIP Test Centre was configured with a 300 MHz AMD K6-2, 32 MB of SDRAM and a 2.1 GB hard disk.

The most pleasing aspect about this computer is the fact that it integrates a number of peripherals which are usually absent in other notebooks in this price range. This includes a sufficiently large 13.3-inch TFT display, 32 MB of SDRAM, integrated floppy and 24X CD-ROM drives and the 300 MHz processor. This configuration, in fact, puts it on the par with much more expensive computers and

thus, keeping the price in mind, Emerald stands out in value.

The touchpad is very sensitive and easy to operate. An S3 Virge display card with 4 MB of Video RAM handles the video and makes the notebook ideal for basic 3D acceleration and other graphics applications that are not overly demanding on the graphics sub-system. In the benchmarks, the notebook performed well in both the graphics-intensive tests—in Photoshop bagged a worthy third place and a second in the Graphics Winmark. Included, as part of the standard accessories, are a compact carry case, service CD and the instruction manuals.

This notebook offers a lot of punch for its price. Options to choose specific hardware, peripherals and accessories make this notebook is very cost-effective. The emerald is ideal for budget-conscious buyers like sales people and students.

VERDICT

A+

ACi Mirage II

The undisputed winner



+ Very large display, 3D acceleration, DVD drive

- Rather heavy, excessive heat dissipation

Processor: PII 300
HDD: 6 GB
RAM: 64 MB
Display: 15.1-inch TFT
Price: Rs 1,89,950 onwards
Dealer: ACi-India
Phone: 022-3683644
Fax: 022-3683645

ACi Mirage II is packed to the gills with power and has a host of one-of-a-kind features that are almost unheard of in the other notebooks in its price range.

What strikes you first about this system is the large 15.1-inch TFT screen. The clarity and sheer size of the display alone could warrant this machine as a desktop replacement. It is powered by a PII 300 (upgradable to PII 366) and with 64 MB (upgradable to 384 MB) SDRAM. The test system carried a 2.1 GB hard disk, but the notebooks that will be released in the market will feature a 6 GB hard disk drive.

The video sub-system is very adequately driven by an ATI Rage LT Pro 3D 2X AGP card which does extremely good justice to the display and is capable of handling a resolution of 1024 x 768 on the LCD display. The Mirage is the only notebook that came pre-configured with a 2X DVD-ROM drive along

with an MPEG II decoder card. DVD playback was flawless and the sound quality was sharp and clear. The floppy disk drive is also integrated with the DVD drive. However, after prolonged use the notebook generated an excessive amount of heat, in spite of having been kept on bare flat surface to allow for adequate ventilation. But this did not, in any way affect its performance. Standard accessories include a large carry case, power adapter, driver CD containing all the requisite drivers for the audio, video and mainboard sub-systems, along with the instruction manuals.

The various sub-systems like processor, RAM, hard disk and even display size can be chosen to create a tailor-made notebook. For those who require a highly customised high-end notebook computer with plenty of options for power and peripherals, the Mirage II is the ideal choice.

VERDICT

A

Compaq Armada 1700

Feature-rich, display-poor



+ Integrated CD/FDD, power supply

- Blurry display

Processor: PII 233
HDD: 3.2 GB
RAM: 32 MB
Display: 12.1-inch STN
Price: Rs 1,43,350
Dealer: Aztech
Phone: 022-4963311
Fax: 022-4963300

Armada is a good, feature-packed notebook that includes most peripherals that a road warrior would need. The CD-ROM drive and floppy disk drive are both integrated into the casing, eliminating the need for swapping them. Especially useful is the front-loading CD-ROM drive, making it very accessible.

The full-size keyboard is firm and responsive and facilitates typing. One minor disadvantage with the pointing device was the fact that the touch pad is located beneath the keyboard but in the centre of the casing, as opposed to lying in the centre of the keyboard. This makes it rather difficult for a touch typist.

The two speakers integrated into the casing on either side of the touch pad provide an adequately loud and clear sound system. This notebook did especially well in the battery mark tests, holding a full charge for a little less than two hours. With

the 12.1-inch STN LCD display, fast-moving images seemed a bit blurry and the contrast was not as good as the TFT screens. Also, banding was observed in the display of some images.

Apart from the usual serial and parallel port, there are a USB and a PS/2 connector for an external keyboard or mouse. The notebook also features a VGA out for an external monitor. One detail that seems to have been missed is that the power plug does not fit into the Indian power outlets so the user has to use a continental adapter. This adapter is, however, not supplied with the notebook and has to be purchased separately.

Apart from these minor short comings, the Compaq 1700 is a good choice for general purpose use. A little more attention to these details could have put this notebook in the forefront of its category.

Compaq Armada 3500

The slim and light alternative



- + Slim profile, lightweight
- No integrated CD or FDD

Processor: PII 266
HDD: 4 GB
RAM: 32 MB
Display: 12.1-inch TFT
Price: Rs 1,88,000
Dealer: Aztech
Phone: 022-4963311
Fax: 022-4963300

The second in the range of notebooks from Compaq, the Armada 3500 is an especially low-profile model. To make the machine light, the manufacturers have excluded all drives from the notebook—there is no integrated floppy disk or CD-ROM drive. However, an external floppy disk drive that can be interfaced with the notebook has been supplied. This particular model featured a PII 266 with 32MB of RAM and a 4 GB hard disk.

Aimed primarily at the highly mobile user, the weight of the Armada 3500 ranges from 2 to 2.2 kilos making it one of the easiest notebooks to carry around. The 12.1-inch TFT display is especially impressive with a very good response time and sharp contrast. Fast-moving images were very clear and free from blurring and banding, unlike other notebooks in the lower range. An integrated pointing stick is used as the

pointing device. Though difficult to get used to, the notebook is very effective once you get the hang of it. Unlike the Armada 1700, this model leaves out the integrated power supply: an external power adapter is supplied and here again, without the continental adapter.

The sound system in this notebook is rather tinny, but can go very loud. The keyboard is very firm and facilitates typing. Battery power was average—lasting for 83 minutes on the test.

With weight and processing power being important considerations in determining the usability of a notebook, the Armada 3500, with the option of being upgraded to a 366 PII and a 6.3 GB hard disk, is a good choice for power hungry users who like to travel light. However, a CD-ROM drive could have been a welcome addition to this light and well performing notebook.

Compaq Armada 7800

Ideal road warrior



- + 3D acceleration, large screen
- Cannot use both the CDROM and floppy disk simultaneously

Processor: PII 266
HDD: 5 GB
RAM: 64 MB
Display: 13.3-inch TFT
Price: Rs 2,14,500
Dealer: Aztech
Phone: 022-4963311
Fax: 022-4963300

Armada 7800 is the top of the range in the Armada series. With a PII 266, 64MB of SDRAM, a 5GB hard disk and a generous 13.3-inch TFT screen, this notebook gives the user ample computing power.

Like the Armada 1700, this notebook features an integrated power supply, enabling easy portability without the need to lug around a separate adapter. One downside is that you can use either the supplied 20x CDRom or the floppy disk drive in the system.

Like the Armada 3500, the large 13.3-inch TFT provides a very crisp and highly responsive display and fast moving images can be displayed without any sign of blurring. Pointing is facilitated by an integrated pointing stick, which was a little too firm. In addition to the single serial and parallel port, there are an integrated USB port, and a VGA out for displaying on an external monitor. Unlike the other two models from

Armada, the 7800 is constructed such that the keyboard is situated right near the bottom edge of the notebook. This does not leave any place for a palm rest.

Quite impressive is the display system, which consists of an S3 Virge GX 3D graphics accelerator with 4 MB of display RAM that runs on a dedicated AGP bus. This makes the notebook suitable for work in 3D graphics and lends itself to a good and crisp display. The 13.3-inch TFT display is capable of supporting resolutions of up to 1024 x 768.

The multi-bay design supports a second hard disk, a CD-ROM drive, a second battery or an LS-120 disk. The OS supplied is either Windows 95 or Windows NT. The test notebook came pre-configured with Windows 98 OSR2.

With support for up to a PII 366 and a whopping 14 GB hard disk, a DVD drive and 3D acceleration, this could be a replacement for a desktop machine.

VERDICT

B+

IBM ThinkPad i1400**The entertainer**

- + Easy controls for audio CDs, good display and sound
- No IrDA

Processor: 266 MMX
HDD: 4 GB
RAM: 32 MB
Display: 12.1-inch TFT

Price: Rs 1,39,400 + taxes
Dealer: TATA IBM
Phone: 080-5269050
Fax: 080-5268553

Part of the newest offering from IBM, the iSeries of ThinkPads incorporates a range of good features. Powered by a 266 MHz mobile MMX Pentium processor, 32 MB of RAM and a 4 GB hard disk. Particularly impressive about this notebook was the crisp 12.1-inch TFT display powered by a NeoMagic MagicGraph 128ZV+ graphics controller. It handled full-motion video with ease and there was no blurring on the display.

Both the 24X CD-ROM and the floppy disk are integrated into the casing. The access controls on the front edge allow the user to operate the CD drive as a conventional audio CD player without having to power 'on' the notebook. The sound is clear, though not very loud. It is, however, well suited to normal listening of audio and video CDs. Two slim speakers are located on either side of the display. These blend into

the finish. There are three mouse buttons that can be configured for use. A responsive and smooth integrated pointing stick functions as the pointing device. The serial, parallel, PS/2 and USB ports are present on the rear of the device. However, the IrDA port that is present in all of the other notebooks was ominously absent.

Bundled with the system is the carry case, the power adapter, a recovery CD and a CD-ROM containing all the necessary drivers for the video, audio, and PCMCIA sub-systems. We also received a 56K V.34 modem along with the external phone adapter and the related driver diskette.

The ThinkPad iSeries 1400 is a good choice for users who are not fussy about the amount of computing power, but are more interested in functionality and ease of use. It is well suited for office suite applications, for Web surfing and MPEG playback.

VERDICT

B-

Toshiba 330CDS**Average performance at a decent price**

- + Attractively priced
- Blurry display

Processor: 266 MMX
HDD: 4.1GB
RAM: 32MB
Display: 12.1-inch dual scan

Price: Rs 1,09,500
Dealer: HCL Infosystems
Phone: 98210 89511
Fax: 022-8525069

Aimed at the lower segment, the 330CDS incorporates many features but compromises on power and performance. This model comes with a 266 MHz MMX processor with 32 MB of RAM, a 4.1 GB hard disk and a 12.1-inch dual scan display. The multimedia subsystem comprises a 24X CD-ROM drive, a 16-bit Yamaha soundcard and integrated stereo speakers. The sound quality of the speakers is fair, though not loud.

This laptop stood out in the battery test where it lasted for 130 minutes, second only to the Mirage II. The 330CDS features integrated CD-ROM and the floppy disk drives. Like the Armada 3500, the power supply is external—a disadvantage for those who are constantly on the move.

Since the display is of a passive matrix type, fast moving images are blurry and the response time is slow compared to the newer and more advanced active matrix displays.

Video and fast moving games are rather blurry and are not as sharp as those with TFT displays. The graphics controller consists of a Chips and Tech 65555 PCI VGA card with 2 MB of on-board video RAM. It also features a USB interface, a serial and a parallel port along with the customary PS/2 port for interfacing a compatible mouse or keyboard. An integrated IrDA port allows data transfer rates of up to 4Mbps.

No accessories are supplied along with the notebook. All that came along with it was the instruction manual and the adapter. The carry case is optional and you have to pay extra for it.

This notebook is not very powerful and is not suited for graphically challenging applications like MPEG video playback. It is, however, best suited to those who are not too insistent on extreme power and who are looking for a good trade-off between price and features. ▶

Twinhead Slimnote VX High on looks, easy on the biceps



- + Both drives included, 2 USB ports, integrated 56K modem
- + Thin and lightweight

Processor: PII 233
HDD: 4.3 GB
RAM: 32 MB
Display: 12.1-inch TFT
Price: Rs 1,34,950
Dealer: Aekay
Phone: 022-6151261
Fax: 022-6108485

Standing 39mm high and weighing just 2.9 kg, this Taiwanese notebook has struck a very good balance between price, performance and features. Incorporating a PII 233 with 32 MB of SDRAM, 4.3 GB hard disk and a 12.1-inch TFT, it compares very well with other notebooks in its range and emerges a good choice. The CD-ROM drive and FDD are integrated. Most evident is the welcome change from the usual black casing: this notebook sports a pleasing matt-silver finish.

The TFT active matrix display was very sharp and showed good response with fast moving graphics. This is also the only notebook that came with two USB ports integrated. Attention is paid to the Internet, with the integrated 56K V.90 built-in modem. This is isolated from the two separate PCMCIA slots which can accommodate either two Type I or Type II cards, or one Type

III PCMCIA card. The usual serial, parallel, VGA out, and IrDA ports are also present. The pointing device is a touchpad which is located in the centre and beneath the spacebar, as opposed to the usual approach of placing it in the centre of the casing.

The documentation supplied with the notebook is very exhaustive. A detailed users manual explains the features, specifications, usage and maintenance of the device. A spiral folder further elaborates the construction details and compares Twinhead with other computers in its range. Also bundled is a licenced version of Windows 98 and the service CD-ROM containing the various system drivers.

With good overall performance, a host of features, accessories and low weight, this notebook is a very good choice for those who need power and are frequently travelling.

CONCLUSION Ace performance by ACi

The clear winner in this roundup is the Pentium II-based system from ACi—the Mirage II. In terms of the configuration and the peripherals, this computer is more powerful than any of the other notebooks reviewed.

The Mirage achieved the first place in all the tests except the Photoshop 4.0 and the disk Winmark. This is because the test notebook carried a 2.1 GB hard disk due to the unavailability of a larger disk drive at the time of the test. However, for the sale price indicated, the machine features a 6 GB hard disk drive.

Considering the price tag on the Mirage II, this machine packs an impressive array of cutting-edge peripherals. This includes the 15.1-inch TFT display—the largest available for a notebook computer, an ATI Rage Pro LT 3D graphics accelerator with 8MB of video RAM, a 2X DVD-



ROM drive and an integrated 56K modem. The powerful processor gave a blazing performance and could be scaled even higher by opting for a PII 366, here again, the fastest processor available for a notebook computer. Video playback through the DVD-ROM drive, as well as 3D graphics is handled effortlessly and faster than the other test notebooks. Especially impressive is the large display that

makes it an ideal choice for presentations and graphics professionals.

On the value front, ACi again bagged the award for the best in the category with its Emerald. Configured with an AMD K6-2 300, 32 MB of SDRAM, a 13.3-inch TFT display, integrated 16-bit sound and a 24x CD-ROM drive, it was more powerful than any other machine in its category. Devices like an integrated modem, and other peripherals are options that can be added on, depending upon the budget.

With a string of firsts for notebook peripherals, and the very moderate pricing offered and a philosophy of providing custom-made notebooks to suit the individual user, the ACi notebooks will appeal to users ranging from those who need just the bare computing essentials, all the way to the power-hungry.